# METAL INDUSTRY

VOLUME 93 NUMBER 24 12 DECEMBER 1958

## Scientific Policy

REPORTING on the national effort in research and development, the Advisory Council on Scientific Policy reiterates its opinion, expressed in 1957, that the proportion of the nation's scientific manpower engaged on research in universities is reasonable but, at the same time, that the provision of certain kinds of equipment and the employment of more technicians would enable scientific research workers in universities to do more effective work. It is also suggested that contract research, financed by industry, should not be allowed to grow to proportions which would hamper the universities in their primary function of increasing our store of fundamental knowledge, although increased contact between academic workers and those in industrial laboratories should be encouraged, possibly stimulated by grants from industry for free as opposed to contract research.

Compared with 1955, the total number of scientists and engineers who qualified for the first time in 1957, either by university degrees or by admission to professional institutions, was up by about 18 per cent, the figure for the last year being about 13,000. In this connection it is of interest to note that the number of honours degrees awarded in metallurgy was practically constant for both years at 111 and 109 respectively, a five-fold increase on the years 1938-39. In recent years the average annual rate of increase in the number of students admitted to full-time courses in university departments of science and technology has been over 10 per cent. On the expectation that some two-thirds of the additional students will read for degrees in pure science or technology, the student population in these departments will increase from 35,000 (October, 1957) to about 55,000 by 1966, an increase of some 5 per cent per year, so it is estimated on previous experience that the numbers graduating will be just over 12,000 a year.

The number of students attending advanced courses in technical colleges has also increased. An indication that the expansion programme for the technical colleges is bearing fruit is that over 10,000 Higher National Diplomas and Certificates were awarded in 1957, as compared with 9,300 in 1956 and 8,600 in 1955. By the mid-1960s it is expected that some 9,500 a year will achieve professional status after completing technical college courses, and provided that the expansion continues in the late 1960s, the number might rise to 10,500 a year by 1970. Thus at that time, if both universities and technical colleges succeed in carrying out their plans, they will together be providing about 22,500 scientists and technologists a year, leaving a small margin in hand over the target of 20,000.

Current estimates indicate that, by 1967, about 50 per cent of those who stay at school until seventeen (probably of the order of 100,000) will be able to proceed to some form of training of an academic character, suggesting that there should be no lack of young people of ability to fill the available places, always provided that the schools can find enough qualified teachers. The increase in the output from the universities should, of course, lead to an increase in graduates who decide to take up teaching, but it is the teachers now in post who will have to bear the brunt of the pressure. Incidentally, the technical colleges also will need to increase their graduate science and technology teachers substantially to achieve the targets set for 1960-61, and these increases can be secured only from graduates already in existence or from those who will be completing their courses within the next few years. It is obvious, therefore, that conditions in teaching must be made at least as attractive to scientists as they are in industry.

# *Out of the* MELTING POT

**Looking In**

NO simple explanation is as yet available of the way in which metal fragments become detached from metal surfaces sliding at low speeds. Like the breaking of a clock or watch mainspring into more than two pieces, the phenomenon of the formation of these loose unattached wear fragments admits of no immediately obvious simple explanation. At the same time, however, probably the best way of finding out any explanation would be simply to look into the matter. A start with doing just that has recently been made at the Scientific Laboratory of the Ford Motor Co. at Dearborn, by mounting a low-power microscope to examine, during sliding, the contact between a hemispherically-ended copper rider pressed against the curved surface of a large cylindrical copper drum, rotated at a surface speed of 0·038 cm/sec., while the rider is moved slowly parallel to the cylinder axis to avoid retracing of the path on the surface of the drum. The main initial observation made in these experiments was the formation of a wedge at the leading edge of the rider by metal fragments torn from the drum surface. This wedge forces the drum and the rider apart. From time to time, the wedge breaks away from the rider and is carried away on the drum surface. A new wedge at once begins to form. The formation of these wedges reduces the wear of the rider to quite a small amount. Any welding that occurs is, therefore, usually not between the two surfaces but between one surface and the wedge, and also between the fragments forming the wedge. The welds between these fragments are apparently quite weak, since from time to time fragments are dislodged from the wedge and fall away as loose particles. One function of a lubricant could be to prevent the growth of wedges by inhibiting cohesion between the metal fragments. The details of how metal is torn out of the surface and incorporated into the wedge require further investigation. Some sort of ploughing action and effects of asperities may be involved. In this connection, a possible analogy with the phenomenon of the built-up edge observed in metal cutting comes to mind.

**Full Use**

THE recent return of Sir John Cockcroft from a trip to Russia has provided yet another occasion for counting the outputs of scientific and technical "bods" from the establishments for higher learning in Russia and in this country respectively. The said bods are numbered in thousand and tens of thousands in the one country and in hundreds in the other. Simple proportion, together with differences in organization, methods, etc., also result in a much more rapid rate of advance in Russia: their version of ZETA was produced in six months instead of eighteen. The conclusions arrived at as a result of all these additions and multiplications are sufficiently familiar. The "solutions" that have been suggested are likewise quite familiar: more graduates, more pay, more, more, more. . . . Numerical solutions to numerical problems require little thought. So little, in fact, that there is none left by the time when, as in the case under consideration, one runs out of numbers for the simple reason that there are no more. On such an occasion one finds oneself wishing for somebody to hold up one of those notices sometimes to be seen hanging on the wall, of a cartoonist's impression of a drawing office, laboratory, or the like. The notice carries just one word: "THINK." Think, for a start, how very little time for thinking is left nowadays by the preoccupation with counting, be it on the fingers of one's hand, on one's slide rule, or on the latest digital computer, and by the preoccupation, once the counting has been done, with the plotting or tabulating of the results, and by the preoccupation with their significance, statistical or otherwise. This preoccupation with counting is worse than the proverbial concern with the number of as yet unhatched chickens, because in most cases, even when hatched, the results are hardly any more substantial than the numbers one first thought of. Because thinking is so much more spontaneous than either doing or counting what one has done or what one intends to do, is no reason why it should be taken for granted and confined to any spare time that happens to be available. Some full-time thinking could certainly do no worse (and is, in fact, the only possible way of doing better) than trying to work out a problem to which there are obviously no numerical solutions.

**Ignored**

ALTHOUGH much less marked in recent years, the tendency to keep apart the mechanical and the chemical or physico-chemical aspects of some observed behaviour of a metal still persists. A typical example of this tendency is to be found in an account briefly reporting the results of some fatigue tests on lead. These tests were carried out in air and in a partial vacuum ($5 \times 10^{-3}$ mm. Hg). Annealed and chemically-polished flat cantilever-bend specimens were used. In accordance with expectations, there was an appreciable increase in fatigue life when the specimens were tested in vacuum. Specimens tested in air failed along grain boundaries with little surface deformation. Specimens fatigued in vacuum, on the other hand, developed sets of furrows in the maximum shear stress direction, i.e. at about 45° to the specimen axis, and failure took place along certain of those furrows. Comment on these observations is interesting for the way it studiously avoids mention of any possibility of an interaction between the metal and atmospheric oxygen or other gases. It is thought that the above observations suggest that fatigue in vacuum causes more surface deformation, even though the fatigue life is greater. These observations support the view that fatigue cracks form at an early stage of the life in air. Bend tests on specimens fatigue stressed in air for a fraction of the anticipated life resulted in the opening up of cracks, whereas bending of specimens treated similarly in vacuum showed no evidence of cracking. It is, therefore, suggested that the presence of fatigue cracks in the surface of air-tested specimens relieves the surface stress, which consequently reduces the surface deformation. No mention is made of the part (slip-locking) undoubtedly played by adsorbed gas (or oxide films formed on the surfaces freshly exposed by deformation) in limiting deformation in air-tested specimens on the one hand and in shortening their fatigue life on the other.

*Skimmer*

INFLUENCE OF PARTICLE SIZE OF NUCLEI-FORMING SUBSTANCES OR REACTION MIXTURES

# Grain Refining Light Alloys

By Dr. H. KESSLER

*This article describes investigations into the effects of the size of the particles of grain refining conditions on the microstructure of the metal and suggests that finer grinding of such additions might have beneficial effects. The author of this article, which has been specially translated from "Metall," is associated with Aluminiumwerke Nurnberg G.m.b.H.*

USING one of the numerous casting processes, it is possible to obtain parts generally requiring only very little machining to bring them to the desired finished dimensions. While the shape of the castings is thus determined by the shape of the mould and by any subsequent machining, the structure of the castings must be controlled by the choice of the casting process, by controlling the temperature of the mould, or by appropriate treatment of the molten metal. The structure of the metal of the finished casting determines chiefly the local mechanical and other properties of the material which should be such as to match the thermal conditions and the mechanical stresses encountered by the casting in service.

Considerable differences in structure of one and the same alloy can already be achieved in castings by the choice of different casting processes (sand-casting, die-casting, pressure die-casting). Additional control of the structure can be obtained by controlling the temperature of the mould, e.g. by heating or cooling portions of the mould, whereby a fine-grained dense structure of the casting in general, or of certain portions of it, can be produced which will result in improved mechanical and other properties. The use of chills to produce effects of this type has been known for a long time.[1] Such chills consist either of inserts of metals of good thermal conductivity in the mould wall, or comprise air-cooled or liquid-cooled portions of the mould wall itself. Use can also be made of chill cores extending into the interior of a casting to produce similar structure-controlling effects. In other special cases, on the contrary, the desired influence on the structure of a casting may require the heating of a portion of the mould wall.

All such methods, however, are usually able to produce only a localized effect on the structure of the metal of the casting. Because of this it has for a long time been found desirable to control the structure by treatment of the molten metal, as, for example, in the case of aluminium alloys, by the introduction of special alloying elements, e.g. small amounts of titanium, which have an effective grain refining action. The use of such methods of grain refining is, however, always restricted to alloys of similar composition; different groups of alloys—ferrous alloys, non-ferrous alloys and light metal alloys—requiring special individual additions to obtain the maximum effect on the structure.

A particularly important type of alloy commercially may be used to illustrate this problem in more detail.

In the case of aluminium-silicon alloys with silicon contents appreciably above the eutectic composition, attempts have been made for many years past to achieve not only a fine-grained structure, but also to ensure that the primary silicon crystals should be small and distributed as uniformly as possible throughout the solid solution matrix.

Numerous methods of treating the molten alloy to produce the above effect have been described, the majority of them consisting essentially in the introduction of phosphorus in some form or other (phosphorus pentachloride, copper-phosphorus alloy) into the alloy. Because of the similarity in crystal structure and lattice constants of aluminium phosphide and silicon, the aluminium phosphide nuclei that are formed act as nuclei for the primary silicon crystals.[2]

These methods have their drawbacks—the addition of copper-phosphorus alloy introduces undesirable copper into the alloy, while in the case of phosphorus pentachloride there is the problem of the most unpleasant smell—and a compound has been developed which avoids these drawbacks while, at the same time, it achieves both desiderata: the refining of the silicon primary crystals and their uniform dispersion throughout the solid solution matrix, and also the grain refining of the latter.

In the course of a detailed study of a grain refining material (Alphosit) it was found that its particle size, achieved as a result of different grinding treatments, has a marked effect on the structure of the hypereutectic aluminium-silicon alloys treated with it, and thereby also a more or less pronounced effect on their mechanical properties.[3]

The values of the tensile strength and elongation, for example, were higher by some 10 to 15 per cent and 25 per cent respectively in the case of fine-grained, as compared with coarser grained alloy. Machinability is also appreciably improved. Surface rough-

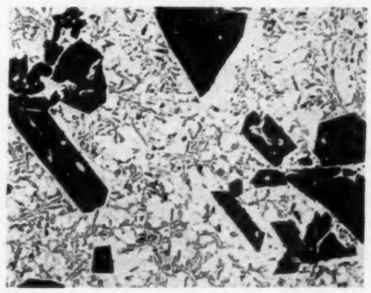


*Fig. 1—Aluminium-23 per cent silicon alloy, untreated (×85)*

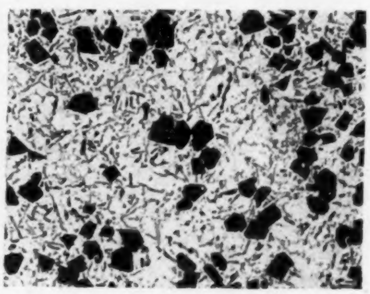


*Fig. 2—Influence of coarse grained grain refining agent on the structure of aluminium-23 per cent silicon alloy (×85)*

*Fig. 3—Microstructure of an aluminium-23 per cent silicon alloy after treatment with a finely ground grain refining agent (×85)*

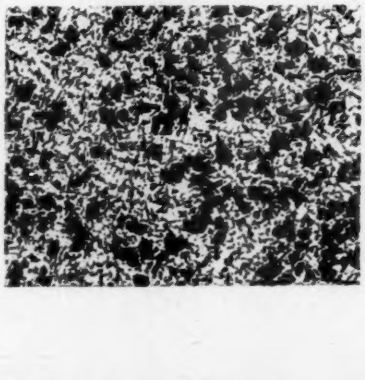
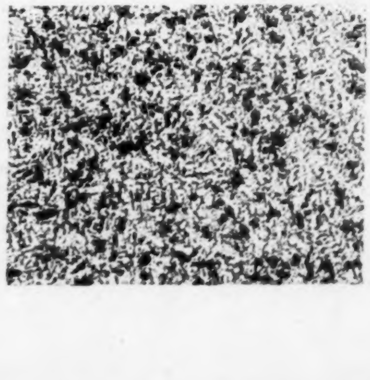


*Fig. 4—Structure of aluminium-23 per cent silicon alloy after treatment as in Fig. 3 and careful cooling in a special mould (×85)*



ness measurements on turned specimens showed that effective grain refining brought about a noticeable improvement in surface finish.

The above remarks may be illustrated by the photomicrographs of the different grain structures. Fig. 1 shows the structure of a normal untreated aluminium silicon alloy with 23 per cent silicon. The addition of the grain refining agent brings about not only a refining of the structure, but also reduces the size of the primary silicon crystals. The grain refining agent consists of red phosphorus ground with a salt flux mixture.

The difference in particle size of the grain refining agent, following different grinding treatments of the latter, results in definite differences in the structure developed by the alloy (Figs. 2 and 3). With the salt flux crystals having a length of side of between 0·14 and 0·6 mm., and the diameter of the particles of red phosphorus, of which a certain proportion is present in the grain refining agent, being around 0·06 mm., the addition of between 0·65 and 0·8 per cent of the refining agent by weight relative to the weight of the melt, produces a microstructure as illustrated in Fig. 2.

With a finer grinding of the addition agent (length of side of the salt crystals between 0·02 and 0·06 mm., and the diameter of the particles of red phosphorus being about the same as above), a microstructure as shown in Fig. 3 is observed.

A very fine grain size, as well as very small primary silicon crystals (as shown in Fig. 4) can be obtained by a choice of the most favourable conditions in regard to the casting process and the mould, together with a careful treatment of the melt.

### Conclusions

The investigations referred to indicate that the grain refining of casting alloys can be favoured by grinding the grain refining agents or reaction mixtures as finely as possible. The above observations made on a light metal alloy of a certain special composition, may, in all probability, be taken as applying in the case of other light and heavy alloys so far as the effect on the fineness of the grain structure of the particle size of the grain refining agent is concerned.[4] In all such cases, an extremely fine homogeneous microstructure will always contribute to the improvement of the mechanical and physical properties of the casting alloys.

References

1 R. Irmann; "Aluminium Sand and Die Casting." 5th Edition. 1952, pp. 174, and 255.

2 Thudy and H. Kessler; *Z. Metallkunde*, 1955, **46**, 12.

3 H. Kessler and Winterstein; *Z. Metallkunde*, 1956, **47**, 2.

4 E. Scheil; *Giesserei*, 1956, **43**, 2.

# Level Control

IN new capacitance operated level control and indication equipment introduced by Lancashire Dynamo Electronic Products Limited, of Rugeley, Staffs., transistor oscillators are used to replace oscillator valves in the detector circuit which registers the change in capacitance at a probe or similar electrode on the approach or recession of a material. The equipment is of two types: the T.L.C.1 (single level) and the T.L.C.2 (multi-level).

In the transistor oscillator circuit, the external capacitance represented by probe and earth is connected to the tuned circuit of the oscillator.

With the high level probe unit, oscillation occurs when the probe is clear of the material, and under these conditions the relay in the control unit is energized. When the material reaches the level of the probe, the change in capacitance causes the oscillation to be reduced and finally cease. The reduced amplitude of oscillation is detected by a further transistor circuit which, in turn, releases the control relay.

With the low level probe head unit, the system operates in reverse, the relay in the control unit being energized when the probe is completely immersed.

In both high and low level control, the circuit is so arranged that failure of equipment or supply will cause the installation to fail to safe.

In these instruments, the entire level detector circuit is housed within the probe head casting. The remote control unit can be mounted any distance away from the probe head unit, with only three interconnecting wires. All wiring external to the remote control unit is at a maximum potential of 12 V D.C. to earth. The maximum current which can be drawn in the connecting cables under short circuit conditions is 50 mA D.C.

In design, the equipment is integrated with a common form of probe head unit, which will accept the various electrode assemblies, these having configurations to suit the application.

# Correspondence

*Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns*

## Induction Heated Die-Casting Machines

TO THE EDITOR OF METAL INDUSTRY

SIR,—At the present time considerable interest attaches to Soviet advances in the metal-working industries, and the text of the article abstracted from *Metalurizdat*, which appeared in METAL INDUSTRY for 5 December, 1958, shows the Russian die-casting industry as being fully aware of the improvement and simplification of metal-melting techniques made possible by induction heating.

The interest in such articles in Western countries would, nevertheless, be even greater if the figures used to illustrate them related to actual Soviet installations, but this is not invariably the case. In this particular article, for example, Fig. 2 is reproduced from an article in a U.S. journal dealing with an Ajax-Tama development, Fig. 4 is a standard figure of an "Ajaxomatic" installation taken from an Ajaxa-Tama brochure, whilst Fig. 3 is a copy of Fig. 6 on page 163 of my book "The Die-casting Process," reproduced with such faithfulness as to duplicate drafting imperfections such as the non-central placing of *B* between the two furnaces *A*.

It would appear, from your abstract, that the article in question was a reprint, or re-write, of part of the book *Indukshionnye Pechi Dlya Plavki Metallov I Splavov*, by Farbmann and Kolobiev (Editions *Metalurizdat*, Moscow, 1958), which gives exactly the same details and also reproduces some other drawings of mine which first appeared in a British technical journal.

As you know, Sir, the definition of line drawings suffers when they are re-photographed from the printed figure instead of from the original large ink drawing, and as I have in hand the artwork originally published with some hundreds of my articles and Papers on die-casting, I would like, through your columns, to offer the loan of the original drawings to any of my Soviet colleagues who contemplate publishing details of recent advances in our common art.

Yours, etc.,

**Hiram K. Barton.**

Roughfield,
Etchingham,
Sussex.

## Obituary

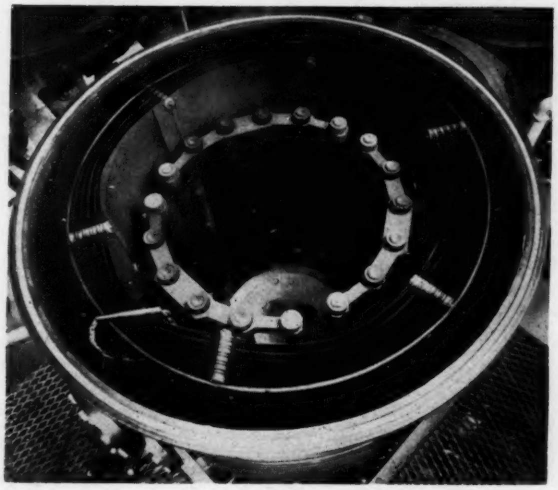
### Mr. D. Howard Wood

IT is with deep regret we record the death of Mr. D. Howard Wood, founder and managing director of the Constructional Engineering Co. Ltd., which he formed in 1914, and of which he retained control, together with its associated businesses, until his death. He was a past-president of the Institute of British Foundrymen, and for more than 30 years was a council member of the Foundry Trade Equipment Association. He had also been independent chairman of the Midland Ironfounders Association, and was a Liveryman and Freeman of the City of London.

# Vacuum Heat-Treatment Furnaces

TWO vacuum furnaces, each with its own control gear and vacuum pumping system, have recently been installed at the Witton (Birmingham) Rectifier Works of The General Electric Co. Ltd. Both are of G.E.C. design and manufacture.

The larger of the furnaces has usable dimensions 24 in. high and 15 in. diameter. The body of the furnace is a water-cooled, vertical, cylindrical, mild steel tank, clad on the inner surface with stainless steel. The tank is covered with a hinged, domed lid which is operated by hydraulics. Faced flanges, with rubber seals on the lid and the body of the furnace, form a vacuum-tight seal.



*The chamber of the larger vacuum furnace, showing the element assembly and radiation screens*

Graphite bars form a circular element assembly that surrounds the charge, which is heated by radiation. The element operates at a low voltage supplied by a three-phase transformer, the output of which is steplessly variable by means of a voltage regulator to give control over the heating rate.

Thermal insulation consists of radiation screens of stainless steel and molybdenum sheets arranged to enclose the heating chamber.

The vacuum pumping system consists of a gas ballast pump, a combined booster and oil diffusion pump, and a valve block which controls the evacuation of the furnace chamber. The valve block is fitted with a five-position operating lever, which can be moved in one direction only to ensure the right sequence of operations. An operating vacuum better than $10^{-4}$ mm. Hg can be obtained. The gas ballast pump is interlocked with the power supply, so that a failure of the pump automatically causes an interruption in the electric supply to the element.

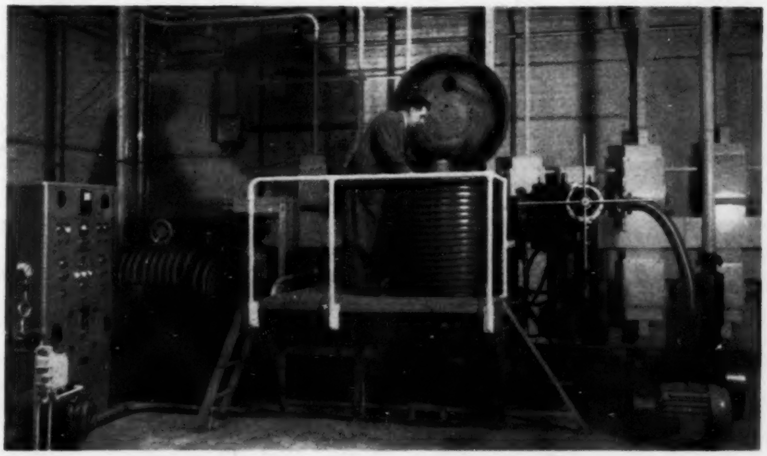
Cooling water for the diffusion pump circuit is taken direct from the mains. For the cycles of heating and cooling on this installation, the remainder of the cooling circuits use a recirculating water system with a 300 gal. storage tank. The water is pumped round the circuits, its maximum temperature being governed by a thermostatic valve in the pump line. As the temperature of the water approaches 120°F. the valve starts to open, to allow water to run to waste and cold water from the mains to enter the tank. The valve closes when the water temperature has fallen below the valve setting.

The cooling circuits are fitted with water flow switches, which cut off the power supply to the elements in the event of a water stoppage. Failure of the water pump would also cut off the element supply and, by opening a magnetic valve and temporarily running water to waste, maintain an emergency, gravity fed, supply of cooling water through the furnace from the make-up and storage tank.

The furnace is rated at 120 kVA, which allows for rapid heating, if necessary to the normal operating temperature of around 1,200°C. Provision is made for the forced cooling of the furnace by introducing argon or hydrogen into the chamber.

The other furnace is generally similar but has usable dimensions 12 in. high and 9 in. diameter. It will provide temperatures up to 1,800°C.

*General view of the larger of the two G.E.C. vacuum furnaces installed at the Company's Rectifier Works at Witton, Birmingham*



## Brazing Titanium

DIFFICULTIES encountered in the brazing of titanium and its alloys, and stainless steels, are minimized by the use of fluxes containing silver or copper chloride, according to a patent granted to the National Research Development Corporation and reported in the *N.R.D.C. Bulletin*. Preparation of the surface includes heating in contact with the flux, abrading the metal surface underneath the molten flux covering, and applying brazing metal to the surface under cover of the molten flux. Abrading may be carried out with the stick of brazing metal as the layer is built up, and surfaces coated with a layer of brazing metal may then be brazed in the normal way.

Silver chloride may be used in the flux, or additions of copper chloride may be made, the ratio of copper chloride to silver chloride being preferably in the region where the equivalent metal content is near the eutectic, i.e. 30:70 and 35:65. A ratio of 40:60 has also been found successful.

# NON-FERROUS CLUB – ANNUAL DINNER-DANCE

ONCE again, the Non-Ferrous Club held its Annual Dinner-Dance at the Chadwick Manor Hotel, Knowle, last week, and this page shows some of the 180 guests who were present.

*Left: Mr A. H. Wilson, Mrs. Merritt, Mr. W. H. Demel, Mr. and Mrs. C. J. Pemberton, Mr. L. Eyre, Mrs. W. H. Demel, Mr. and Mrs. J. Bayley*

*Mr. and Mrs. A. Harrison, Mr. and Mrs. H. Sprayson, Mr. and Mrs. C. Hansford, Mr. and Mrs. W. Lackey*

*Mr. G. E. Boughton, Mr. and Mrs. E. R. S. Wrighton, Mrs. Boughton, Mr. J. D. Ellwood, Miss S. M. Wrighton, Mr. and Mrs. P. S. Crisford*

*Mr. and Mrs. B. A. Taylor, Mr. and Mrs. N. F. Manthorp*

*Mr. and Mrs. E. West, Mr. and Mrs. H. McGhee, Mr. and Mrs. T. Rhodes*

*Mr. and Mrs. T. B. Taylor, Mr. and Mrs. M. A. Harper, Dr. and Mrs. H. Proctor*

*Mr. and Mrs. D. Devereux, Mr. and Mrs. J. W. Wakelin, Mr. and Mrs. M. Lane, Mr. and Mrs. J. Whitworth*

*Mr. and Mrs. T. C. Gough, Mr. and Mrs. W. R. Sharland, Mr. and Mrs. J. Raybould*

*Mr. and Mrs. T. G. Ellison, Mr. and Mrs. G. J. Broughton, Mr. and Mrs J. L. Meaking*

**Finishing Supplement**

# Preflux Solutions from Galvanizers' Sal Skimmings

By P. M. SULLIVAN, D. H. CHAMBERS and P. J. BERNEY

*Galvanizers' sal skimmings have been treated by two methods of leaching in attempts to produce preflux solutions suitable for use in galvanizing operations. Both the water-leaching and acid-leaching procedures described in this United States Bureau of Mines Report No. 5421 are effective, except in severely exhausted skimmings when water-leaching becomes impracticable. A preliminary analysis of the skimmings is not required. Solutions can be produced conveniently by control of pH, specific gravity, and chlorine content. A short period of training would enable a technician to operate the process.*

PREFLUXING or flux washing is standard practice in many modern hot-dip galvanizing operations. Authorities on galvanizing procedures recommend that the wash solutions be prepared from zinc ammonium chloride crystals containing 1 mole of zinc chloride combined with 3 moles of ammonium chloride.[1,2,3] Spowers and Baldwin emphasize the importance of obtaining a film of this salt on the surface of articles to be galvanized by immersion in zinc ammonium chloride solutions before hot dipping. The film protects the newly cleaned surface from oxidation, and provides a final cleaning of the surface when the film fuses on passing through the galvanizing kettle flux. The fused film, which has the same composition as the kettle flux, also serves to replenish part of the flux blanket lost by volatilization.

Normally, 20° Bé (Baume) solutions are used, although in certain applications either stronger or weaker flux washes are required. One manufacturer of zinc ammonium chloride flux recommends 18° Bé for general use. Such a solution contains 2·75-3 lb/gal. of the solid salt. This composition is maintained by adding flux crystals as the salt is being consumed. [*The U.S. gal. is used throughout this report. 1 Imp. gal≡1·20095 U.S. gal.—Ed.*]

Salts present in the wash solutions are available at most galvanizing plants in the form of waste kettle flux, commonly called sal skimmings. Leaching this material to prepare preflux solutions at the galvanizing plant would offer savings over present methods of dissolving commercial salts and provide more effective utilization of an objectionable waste material.

## Materials

Sal skimmings are essentially spent zinc ammonium chloride flux. In its original form, this flux is a crystalline double salt containing 3 molecules of ammonium chloride per molecule of zinc chloride. It is used on the surface of the zinc bath to provide a final cleaning of materials to be galvanized. The composition of the flux gradually changes, owing to chemical reactions occurring during cleaning and to losses by volatilization. The blanket then becomes viscous and ineffective, and must be skimmed off and replaced. These skimmings, containing part of the original flux mixed with oxides, free zinc, and some foreign material, are known as sal skimmings. Generally, they contain about 50 per cent zinc and 10 to 20 per cent chlorine, with minor amounts of ammonia.

Sal skimmings for these tests were procured from several sources. Chemical analyses of these skimmings are given in Table I. All other materials used in this study were standard laboratory reagent grade.

## Experimental Procedures

Two leaching procedures were tested in this study. A counter-current plain water leach was made to extract soluble salts only, leaving as an insoluble residue any free metallic zinc and complex basic salts. A hydrochloric acid leach was also made, which extracted both the soluble salts and insoluble basic complexes. The plan followed in both procedures was to (1) leach the skimmings to produce a solution having specific gravity higher than finally desired; (2) dilute the leached solution back to the desired specific gravity; and (3) adjust the solution composition by addition of ammonium chloride.

## Water Leach

The following procedure was used in water-leaching tests:—

(1) Sal skimmings were ground to pass an 8-mesh screen.

(2) Skimmings were slurried with water in a ratio of 6·5 lb. of water to 1 lb. of skimmings.

(3) Slurry was agitated ½ hr., then allowed to settle for about 10 min.

(4) Leach solution was decanted and used to leach fresh skimmings.

(5) Solids left after decanting were washed with clean water (6·5 lb. of water/lb. skimmings). Additional washings were made until specific gravity measurements indicated that no soluble salts were left in the solids. Two washes were usually enough.

(6) Wash solutions were advanced

TABLE I—ANALYSES OF SAL SKIMMINGS (AS RECEIVED)

| Constituent | Per cent by Weight | | |
|---|---|---|---|
| | Sample M | Sample H | Sample V |
| Zn (total) | 53·3 | 55·9 | 69·6 |
| $NH_3$ | 1·74 | 3·48 | <0·05 |
| Cl | 33·1 | 17·3 | 0·47 |
| Fe | 0·17 | 0·38 | 1·1 |

TABLE II—PREFLUX SOLUTIONS FROM SAL SKIMMINGS—WATER LEACHING

| | Leach No. | | | | Control Solution |
|---|---|---|---|---|---|
| | W-4-M | W-7-M | W-10-M | W-13-M | |
| Pregnant filtrate: | | | | | |
| Weight, gm. | 765·7 | 705·5 | 633·4 | 573·1 | |
| Sp. gr., 25°/20°C. | 1·179 | 1·188 | 1·173 | 1·184 | |
| *p*H | 4·9 | 4·9 | 5·0 | 4·9 | |
| Water added to adjust sp. gr., ml. | 97 | 134 | 61 | 94 | |
| Diluted solution: | | | | | |
| Sp. gr., 25°/20°C. | 1·156 | 1·156 | 1·156 | 1·157 | |
| Zn, per cent | 8·15 | 8·16 | 7·97 | 8·15 | |
| $NH_3$, per cent | 0·60 | 0·61 | 1·07 | 0·60 | |
| Cl, per cent | 9·88 | 9·92 | 10·69 | 10·05 | |
| $NH_4Cl$ added, gm. | 157·4 | 153·2 | 115·2 | 118·8 | |
| Prepared preflux solution: | | | | | |
| Weight, gm. | 1,020 | 993 | 810 | 786 | |
| Sp. gr., 25°/20°C. | 1·160 | 1·161 | 1·163 | 1·163 | 1·163 |
| *p*H | 4·9 | 4·9 | 4·9 | 4·2 | 3·7 |
| Zn, per cent | 6·86 | 6·91 | 6·84 | 6·88 | 6·91 |
| $NH_3$, per cent | 5·34 | 5·36 | 5·35 | 5·27 | 5·39 |
| Cl, per cent | 18·7 | 18·7 | 18·7 | 18·7 | 18·7 |

**TABLE III—PREFLUX SOLUTIONS FROM SAL SKIMMINGS—ACID LEACHING**

| Run No. | Slurry Mix | | Conc. HCl. added, mL. | After Leaching | | | $H_2O$ added to adjust sp. gr., mL. | Prelim. chlorine analysis, per cent | $NH_4Cl$ added gm. | After $NH_4Cl$ addition | | Final analysis of preflux solution, per cent | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sal skimmings, gm. | Water mL. | | Weight filtrate, gm. | *p*H | Sp. gr., 25°/20°C. | | | | *p*H | Sp. gr., 25°/20°C. | Zinc | Ammonia | Chlorine |
| A- 1-M | 225 | 800 | 130 | 1,079 | 4·4 | 1·2013 | 338 | 8·91 | 274 | 4·3 | 1·154 | 6·42 | 5·59 | 18·7 |
| A- 2-M | 225 | 800 | 135 | 1,055 | 3·9 | 1·1962 | 298 | 8·91 | 262 | 3·8 | 1·156 | 6·37 | 5·62 | 18·6 |
| A- 3-M | 225 | 800 | 130 | 1,068 | 4·0 | 1·1975 | 312 | 9·01 | 264 | 3·9 | 1·157 | 6·44 | 5·51 | 18·5 |
| A- 4-M | 225 | 800 | 130 | 1,060 | 4·0 | 1·2035 | 300 | 9·22 | 256 | 4·6 | 1·158 | 6·71 | 5·44 | 18·6 |
| A- 5-M | 225 | 800 | 130 | 1,106 | 4·0 | 1·1922 | 230 | 9·37 | 245 | 3·8 | 1·161 | 6·77 | 5·35 | 18·5 |
| A- 6-M | 225 | 800 | 130 | 1,077 | 4·6 | 1·2048 | 312 | 9·26 | 257 | 4·4 | 1·160 | 6·80 | 5·24 | 18·2 |
| A- 7-M | 225 | 800 | 131 | 1,111 | 3·4 | 1·1921 | 208 | 9·70 | 233 | 3·4 | 1·1623 | 7·01 | 5·24 | 18·5 |
| A- 8-M | 225 | 800 | 131 | 1,100 | 3·4 | 1·1936 | 239 | 9·46 | 243 | 3·5 | 1·1602 | 6·86 | 5·28 | 18·3 |
| A- 9-M | 225 | 800 | 135 | 1,106 | 3·2 | 1·1926 | 235 | 9·50 | 242 | 3·4 | 1·1604 | 6·87 | 5·29 | 18·3 |
| A-10-M | 225 | 800 | 135 | 1,101 | 3·4 | 1·1946 | 221 | 9·69 | 234 | 4·1 | 1·1639 | 7·04 | 5·22 | 18·4 |
| A-11-M | 225 | 800 | 133 | 1,116 | 3·7 | 1·1948 | 225 | 9·71 | 245 | 4·5 | 1·1640 | 7·07 | 5·23 | 18·4 |
| A-12-M | 225 | 800 | 130 | 1,096 | 3·7 | 1·1902 | 195 | 9·60 | 245 | 4·4 | 1·1636 | 7·00 | 5·33 | 18·5 |
| A-13-H | 225 | 600 | 250 | 1,034 | 3·0 | 1·2189 | 334 | 10·10 | 242 | 3·1 | 1·1646 | 7·07 | 6·60 | 18·6 |
| A-14-H | 225 | 700 | 245 | 1,109 | 3·6 | 1·1975 | 239 | 10·10 | 223 | 3·6 | 1·1632 | 7·02 | 6·43 | 18·3 |
| A-15-H | 225 | 700 | 239 | 1,111 | 3·6 | 1·1976 | 240 | 10·00 | 242 | 3·4 | 1·1636 | 6·96 | 6·64 | 18·6 |
| A-16-H | 225 | 800 | 251 | 1,229 | 3·2 | 1·1800 | 152 | 10·03 | 247 | 3·1 | 1·1632 | 6·99 | 5·05 | 18·4 |
| A-17-H | 225 | 800 | 253 | 1,221 | 2·9 | 1·1827 | 169 | 10·05 | 247 | 2·8 | 1·1630 | 6·96 | 5·25 | 18·3 |
| A-18-V | 450 | 800 | 330 | 1,047 | 3·3 | 1·1816 | 139 | 9·08 | 233 | 3·1 | 1·1638 | 6·73 | 5·24 | 18·6 |
| Control solution—3 lb. of commercial flux per gallon of solution .. | | | | | | | .. | .. .. | .. | 3·7 | 1·1631 | 6·91 | 5·39 | 18·7 |

to wash the next batch of leached solids.

(7) Pregnant solution was withdrawn from the leaching chain when specific gravity exceeded 1·170.

(8) After pregnant solution was withdrawn, the first wash solution became the primary leaching solution.

(9) This procedure was continued until four batches of pregnant liquor had been withdrawn.

(10) Each batch of pregnant liquor was filtered and diluted with water to specific gravity 1·156.

(11) Diluted solutions were analysed for chlorine content.

(12) Based on results of chlorine analyses, calculations were made to determine the amount of ammonium chloride required to bring the total chlorine in solution up to 18·6 per cent.

(13) After the required amount of ammonium chloride was dissolved, solutions were analysed for zinc, ammonia, and chlorine, and measurements of specific gravity and *p*H were made.

Results of a series of leaching tests by this procedure are given in Table II. In this series, 13 batches, each containing 100 gm. of sal skimmings M, were leached in succession. The control solution was prepared by dissolving the recommended amount of zinc ammonium chloride flux in water.

It is evident from Table II that the procedure outlined consistently produced solutions in the desired concentration range. All measurements made on recovered solutions agreed with those made on the control, except for *p*H. Recovered solution *p*H values were 4·2 to 4·9, compared to 3·7 for the control solution. This represents an extremely small difference in free acid content, and could readily be corrected if desired.

Sal skimmings M yielded 46 per cent soluble salts. The material requirement indicated by water leaching was 3·5 lb. of skimmings and 1·42 lb. of ammonium chloride per gal. of solution; 3 lb. of commercial flux per gal. would be required to make the same solution.

Water-leaching tests on other samples of sal skimmings indicated only minor amounts of soluble salts present. It was not considered practicable to test these materials further.

## Acid Leach

Hydrochloric acid leaching tests were conducted as follows:—

(1) Sal skimmings were ground to pass an 8-mesh screen.

(2) Skimmings were slurried by mixing 3-3·5 lb. of water per lb. of solids.

(3) Concentrated hydrochloric acid (37 per cent HCl) was stirred into the slurry until solution *p*H dropped to 3·5 to 4·5. Final additions of acid were made slowly to avoid lowering the *p*H below 3·5.

(4) Solids were filtered from the solutions, and the specific gravity of the filtrate was determined. Solution gravity was normally greater than 1·17 at 20°C.

(5) Solutions were diluted to specific gravity 1·159 by addition of water.

(6) Samples of solution were analysed for chlorine content.

(7) Based on chlorine analysis, calculation was made for the amount of ammonium chloride required to bring the total chlorine content in the solution up to 18·6 per cent.

(8) The calculated ammonium chloride was added and dissolved.

(9) Solutions were analysed for zinc, ammonia, and chlorine, and measurements of specific gravity and *p*H were made.

Results of acid-leaching tests are given in Table III. The control solution used in these tests was identical with that used in the water-leaching experiments.

The acid-leaching procedure also consistently produced solutions in the desired concentration range. Both *p*H and final specific-gravity measurements agreed well with values determined for the control solution. Insoluble residues appeared to be primarily metallic zinc, and amounted to 5 to 10 per cent of the skimmings treated.

Sal skimmings sample M was easily leached to the desired *p*H and specific gravity. Sample H behaved much like M, except that, owing to a lack of water-soluble salts, nearly twice as much acid was required to produce an extract of the desired *p*H and gravity. Sample V contained less soluble salts than Sample H and an unusually large amount of metallic zinc, a considerable portion being present in a finely divided state. Excessive amounts of hydrogen were liberated during the leach when solution *p*H fell below 4·0. To avoid consuming metallic zinc, it was necessary to start with a more dense slurry and control *p*H at a higher value, resulting in greatly increased leaching time. While it is possible to produce suitable preflux solutions from materials like sample V, it is doubtful whether such a leach is justified owing to the longer reaction time and the hazards introduced by excessive evolution of hydrogen.

Material requirements in the acid leach of sample M were 1·32 lb. of skimmings, 0·91 lb. of 37 per cent HCl, and 1·45 lb. of $NH_4Cl$ per gal. of solution. In the acid leach of sample H, ammonium chloride requirements were slightly less, while acid requirements were nearly doubled.

The acid leach procedure requires control of *p*H to avoid excessive attack of zinc metal. With proper rate of addition of acid and sufficient agitation, the reaction can be confined almost entirely to solubilizing zinc oxide and basic zinc salts. This is illustrated in the curves of Figs. 1, 2, and 3, which represent the change in solution *p*H during leaching at constant rates of addition of acid. At *p*H values above 4·0, the reaction was almost entirely between oxide and acid. Oxide was nearly all consumed when the *p*H reached 4·0. Thereafter, *p*H dropped rapidly with acid addition, indicating

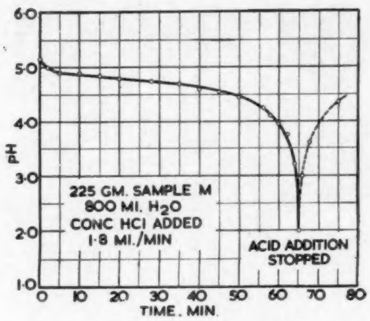



*Fig. 1—Change of pH in acid leaching of sal skimmings M*

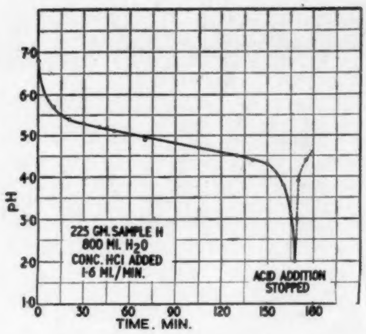



*Fig. 2—Change of pH in acid leaching of sal skimmings H*

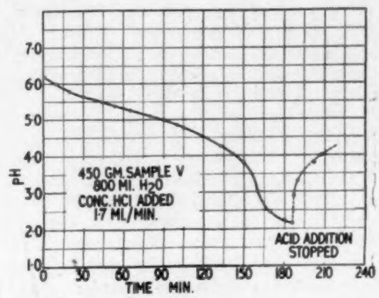



*Fig. 3—Change of pH in acid leaching of sal skimmings V*

attack of zinc as evidenced by vigorous hydrogen evolution.

## Comparison of Methods

Both the acid-leaching and water-leaching procedures are effective, depending on the availability of water-soluble salts. In water leaching, a preliminary solubility test would be advisable to indicate the practicability of proceeding with this type of leach. The amount of soluble salts in the skimmings will, of course, decrease with increasing degree of exhaustion of the flux blanket. Several advantages indicated for the water leaching are:—

(1) Less severe corrosion problems.

(2) Less reagent required; no acid is required.

(3) Most of the chlorine in the final solution is derived from the sal skimming waste.

(4) Control methods are simplified. It is not necessary to control *p*H.

(5) Less danger of generating hydrogen and arsine.

The major disadvantages attending water leaching are (1) the need for processing a larger amount of skimmings to produce a given volume of solution, and (2) the necessity for handling a larger amount of residues still relatively high in chlorine.

The simplicity of control techniques that apply to both procedures should be emphasized. Solution *p*H can be conveniently measured or monitored with an inexpensive *p*H meter. Specific gravity can be read quickly from a common hydrometer. The only analysis required is a chloride determination that can be done according to the Fajans method.[4]

The method is as follows:—

(1) Dilute a 2 mL sample of filtered leach solution with 25 to 50 mL of chloride-free water.

(2) Add 6 drops of dichlorofluorescein indicator and 0·1 gm. dextrin (Karo syrup).

(3) Titrate with 0·2 *N* silver nitrate solution. Avoid direct sunlight falling on the titration. The end point is indicated by a sudden change in the colour of the precipitate from white or light cream to pink.

(4) Calculate per cent chlorine in the sample from the formula—

$$\text{per cent chlorine} = \frac{1{\cdot}773 \times \text{mL} \times N}{\text{sp. gr.}}$$

where mL = volume of silver nitrate used, $N$ = exact normality of silver nitrate, and sp. gr. = specific gravity of solution.

This analysis need not be precise, and an error of $\pm 3$ per cent should be permissible. Ammonium chloride requirements could be read from a previously prepared chart of $NH_4Cl$ vs. chlorine analysis.

Table IV can be used to determine the amount of ammonium chloride required to supply a given solution with 3 moles $NH_4Cl$ per mole of $ZnCl_2$. This Table is applicable only when the solution strength desired is 1·156 specific gravity.

These same procedures can be used to prepare stronger or weaker solutions. If a different solution strength should be desired, it would be necessary to select control points different from the ones described here. These could be established readily by reference to Fig. 4, which shows the increase of specific gravity of preflux solutions with increasing chlorine content.

## Cost of Materials

An analysis of material costs indicates that it would be economically advantageous to galvanizers in preparing their own prefluxes to adopt one of the procedures described.

In the examples described, water leaching offers a saving of 62 per cent in material costs, while acid leaching saves 53 per cent.

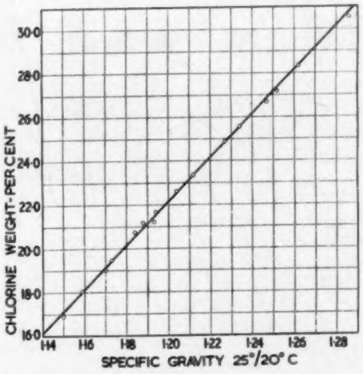



*Fig. 4—Specific gravity plotted against chlorine for solutions of $ZnCl_2.3NH_4Cl$*

## Nature of Salt Films

According to the literature, solutions prepared by leaching sal skimmings are not sufficiently effective prefluxes. The main objection appears to be that the leach liquor contains zinc chloride and ammonium chloride in a ratio different from the desired molar ratio of 1:3. It is further claimed that such solutions, fortified to the ratio of 1:3 by addition of $NH_4Cl$, produce a salt film that loses ammonium chloride on

**TABLE IV—AMMONIUM CHLORIDE REQUIREMENT TO INCREASE SOLUTION OF GIVEN PER CENT CHLORINE TO 18·6 PER CENT CHLORINE**

| Per cent Chlorine | 0·0 | 0·2 | 0·4 | 0·6 | 0·8 |
|---|---|---|---|---|---|
| | lb. $NH_4Cl$ to add per 100 gal. solution at specific gravity 1·156 | | | | |
| 8 | 214·2 | 210·2 | 206·1 | 202·1 | 198·0 |
| 9 | 194·0 | 190·0 | 185·9 | 181·9 | 177·8 |
| 10 | 173·8 | 169·7 | 165·7 | 161·7 | 157·6 |
| 11 | 153·6 | 149·5 | 145·5 | 141·5 | 137·4 |
| 12 | 133·4 | 129·3 | 125·3 | 121·3 | 117·2 |
| 13 | 113·2 | 109·1 | 105·1 | 101·1 | 97·0 |
| 14 | 93·0 | 88·9 | 84·9 | 80·9 | 76·8 |
| 15 | 72·8 | 68·7 | 64·7 | 60·7 | 56·6 |
| 16 | 52·6 | 48·5 | 44·5 | 40·5 | 36·4 |
| 17 | 32·4 | 28·3 | 24·3 | 20·3 | 16·2 |
| 18 | 12·2 | 8·1 | 4·1 | 0·0 | — |

immersion in the galvanizing bath almost as rapidly as if it were added directly to the kettle flux.

To test this theory, X-ray diffraction patterns were procured for powdered films of salt deposited from (1) an acid-leached preflux, (2) a water-leached preflux, and (3) a solution made by dissolving commercial zinc ammonium chloride flux in water. All three samples showed substantially the same X-ray patterns. Each sample was composed primarily of crystals of the salt containing zinc chloride and ammonium chloride in a molar ratio of 1:3. Each sample would, therefore, have the same chemical and physical properties, so that the objections to preparing preflux solutions from sal skimmings appear unjustified.

**References**


1 Heinz Bablik; "Galvanizing (Hot-Dip)", 3rd Ed., E. and F. N. Spon Ltd, London, 1950.

2 W. H. Spowers, Jr.; "Hot-Dip Galvanizing Practice," *Steel*, 1946, **119**, No. 14, 74, 102; No. 15, 134, 172; No. 17, 118, 137; No. 18, 114, 126; No. 19, 118; No. 21, 112; No. 22, 88; No. 23, 123.

3 A. T. Baldwin; "Progress of Fluxing in Hot Galvanizing Practice," *Steel*, 1948, **122**, No. 22, 86, 88, 90.

4 W. C. Pierce and E. L. Haenisch; "Quantitative Analysis," 3rd Ed., John Wiley and Sons Inc., New York, 1948, 295.


# Men and Metals

Appointments recently announced by Thos. W. Ward Limited are those of **Mr. Arnold Carr** to be deputy chairman of the company, and **Mr. Douglas F. Walton** to be a director of the company. Mr. Carr was previously assistant managing director of the company, and is also chairman and director of a number of companies in the Ward group at home and abroad. Mr. Walton has been a local director of the company since 1948, and is also a director of the Ketton Portland Cement Company Limited, Darlington Railway Plant and Foundry Company Limited, and Railway and General Engineering Company Limited.

After an association with Harrison (Birmingham) Limited of nearly thirty years, **Mr. E. C. B. Rowley** has retired from his position with that company as chairman. Mr. Rowley joined the company in 1929 as general manager, and in 1933 was appointed to the board, becoming chairman of the company in January, 1946. For many years Mr. Rowley was a member of the executive committee of the

National Brassfoundry Association, and in 1951 was elected life hon. vice-president. He was also chairman of the Stamped Brassfoundry Association and founder chairman of the British Curtain Rail Manufacturers' Association from its inception in 1931. He was also a prominent member and officer of other trade organizations. For over 20 years Mr. Rowley has been an active supporter of the Royal Metal Trades' Pension and Benevolent Society, and was its chairman from 1945 to 1953.

Three new directors have recently been appointed to the board of Hadfields Limited as follows:—**Mr. Fred Cousans,** F.I.M., who joined the company in 1947; **Mr. George Wood,** A.Met., A.I.M., who joined the company in 1935 as metallurgist, research department; and **Mr. R. C. Heys,** the present managing director of Millspaugh Limited, a subsidiary company of Hadfields.

New staff appointments made by G. A. Harvey and Company (London) Limited include the following:—**Mr. K. Tardif** has taken over the duties of home sales manager, and will continue to operate from the head office at Greenwich; **Mr. H. Barker** has been appointed export sales manager, and will also operate from Greenwich, and **Mr. H. F. Jones** has been appointed London area manager controlling the company's London sales office at 58 Victoria Street, S.W.1.

Elected President of the new Canadian Copper and Brass Development Association, **Mr. J. S. Vanderploeg** is President of Anaconda American Brass Ltd. The senior vice-president of the association is **Mr. R. W. Summey** (vice-president and general manager of Noranda Copper and Brass Limited), while the secretary-treasurer is **Mr. K. H. J. Clarke** (manager of Canadian Sales and Market Development, International Nickel Company of Canada).

Following a complete reorganization of its training facilities, Nu-Way Heating Plants announce the appointment of **Mr. H. W. Burbery** as principal of the Nu-Way school of oil firing. Mr. Burbery was formerly the company's installation and service manager.

One of the Metal Industries group, Fawcett Preston and Company Limited have appointed **Mr. D. D. Teasdale** to be their chief accountant.

# Processing Tin Ore

MODERNIZATION designed to reduce the amount of slimes during the processing of granitic tin ore is being undertaken at the mine of South Crofty Limited. One of the stages in the modernization has been the replacement of the existing California stamps, which have been in use for many years, and Head Wrightson Stockton Forge Limited, a subsidiary of Head Wrightson and Co. Ltd. have supplied a rod mill, screen, and auxiliary equipment.

The plant is designed to reduce the $-\frac{3}{4}$ in. granitic tin ore to all $-20$ mesh product at the rate of 15 long tons/hr., with an estimated circulating load of 150 per cent.

The old layout consisted of 12 five-stamp Californian mills, each battery with feed bin and feeder.

The rod mill plant is arranged between two pairs of batteries; so that eight batteries lie to one side and four to the other.

Two 16 in. horizontal belt conveyors collect the $-\frac{3}{4}$ in. ore from the existing bins and deliver direct to the rod mill feed chute. The mill discharge is taken by a 14 in. bucket belt elevator and delivered to a spreader chute, and thence to a 4 ft × 8 ft. Sherwen screen, with 14 mesh screen. The screen over size returns to the mill and the under size is pumped for classification and tabling. Because of the necessity of fitting the new equipment into the existing plant, with adequate launder slopes, and to ensure the minimum delay in changing over, considerable thought was given to obtaining the most satisfactory layout.

The rod mill is 6 ft. dia. inside shell by 10 ft. long inside end liners. The mill speed is 23·3 r.p.m. and the drive consists of a cast steel machine-cut girth gear, driven through pinion, countershaft and texrope drive from a 200 h.p × 735 r.p.m. motor. The recommended motor power is 170 h.p. but customers installed an existing motor.

The mill is fitted with a mild steel drum feeder, with carbon steel liners and a hard cast iron inner scoop, and is of the overflow type with manganese steel liners.

# Fatigue

A LIST of references to articles published in 1957 dealing with fatigue of structures and materials, entitled "1957 References on Fatigue, STP No. 9-I," has been published by the American Society for Testing Materials. References are generally so arranged that sheets can be cut apart for filing according to any desired plan. Brief abstracts have been included when these were readily available.

Copies of this publication may be obtained from A.S.T.M. headquarters, 1916 Race Street, Philadelphia 3, Pa., at $3.00 a copy.

# Reviews of the Month

## NEW BOOKS AND THEIR AUTHORS

### NIOBIUM

**"The Technology of Columbium (Niobium)."** *Edited by B. W. Gonser and E. M. Sherwood. Published by Chapman and Hall Ltd., 37 Essex Street, London, W.C.2, and John Wiley and Sons Inc., New York. Pp.* viii +120. *Price* 56*s.* 0*d.*

THIS book is compiled from Papers presented at the Symposium on niobium held by the Electrothermics and Metallurgy Division of the Electrochemical Society, Washington, D.C. The title page presents the Symposium as taking place on May 15 to 16, 1958, the remainder of the book refers to the same date of the year 1957. Reference is made to the British Symposium held by the Institute of Metals in May, 1957, and one presumes, therefore, that the American Symposium was, in fact, held in 1957. The Papers cover a wide field, the chemistry of the metal and its compounds, sources and economics of supply, extraction of the metal (including solvent extraction and electrolytic methods). Analytical methods (including gases) are referred to, and several sections deal with mechanical properties, electroplating, and the development of oxidation-resistant alloys. Work on the vacuum reactions during the sintering of niobium appears at the end, whereas one would have expected it to be placed alongside work on the extraction of the metal.

Throughout, the impression is gained that American work on niobium up to the time of the Symposium was concentrated on developments for aeronautical applications (reference electroplating methods and oxidation-resistant alloys). On the other hand, a very short Paper (occupying less than one page) was presented on applications for nuclear reactors. In contrast, the British Symposium (Institute of Metals) was concerned with developments for nuclear energy purposes. The American work is extremely detailed in certain particular subjects, such as fabrication of the material and the structure of rolled sheet. Much of this work is supplementary to that published in this country and this book does, in fact, form a very useful addition to published work available. Taken in conjunction with the Papers presented to the Institute of Metals in 1957, this book should be valuable to all concerned with the development or application of the newer materials, whether in nuclear energy, aviation, or other fields involving heat resistance. Analytical figures quoted in the text of the various Papers give the impression that America is not producing niobium to the same standard of purity as has been achieved in this country. It may be that for the purposes required this was unnecessary; on the other hand, many properties are quoted without reference to the purity. The reviewer, and many others working in this field, have from time to time emphasized the absolute necessity for quoting the true composition of either "pure" niobium or its alloys. The effect of composition is not brought out in the American Papers, and hardly any work is reported on the physical properties. Many of the Papers will be most useful to the chemist or those concerned with the development of material during its extraction and fabrication stages, and can be recommended, as mentioned previously, for its value as a supplement to existing published work. The book cannot be regarded as a textbook, and we still await the first genuine attempt to deal with the more recently explored transition metals in a standard work of reference.

C. R. T.

### FOUNDRY COSTING

**"Costing a Casting"** (*Two Booklets*). *Issued by the Association of Bronze and Brass Founders, 69 Harborne Road, Edgbaston, Birmingham. Pp.* 16 *and* 17. *Price* 30*s.* 0*d.*

A VERY commendable attempt by the Association of Bronze and Brass Founders to give guidance to their members on the costing of castings—the main product of the member firms of the Association—has recently been published. At the outset, the cost committee responsible for the preparation of this publication has set itself the task of recommending a system intended to be eminently suitable for approximately 75 per cent of the bronze and brass foundries in Great Britain. Those outside this figure are the larger foundries, employing more than 50 operatives, which presumably can afford to support an independent cost function within the organization.

On the basis, then, that the system is designed for the small foundry, where clerical help may be no more than one employee, and that such an organization cannot consider incurring the additional cost of such a specialized function, the committee has devoted its attention to the design of a system which utilizes to the utmost current documents, in however crude a form they may be ("back of envelope" notes are included). It has recognized fully that, like its elder and bigger brothers elsewhere, the technical information necessary to build up product costs originates on the shop (or foundry) floor. The practical foundryman is the cornerstone upon which the system is built. This type of process work does not readily reveal losses; expensive material is being used, and there is a trail of loss in the form of scrapped castings, runners and risers, spillings, skimmings, ashes and grindings, all of which contribute to the cost of "Metal Loss." Any system which will help to determine more definitely what this cost is in any particular foundry is likely to receive the approval of the foundryman, and should strengthen his determination to cost his casting.

Having formulated the basis upon which the system is designed, the committee then goes on to show in a practical way how this may be achieved. It deals successively with Materials, Labour, and Overhead Expenses, outlining the special problems which are likely to be encountered in each of these three main elements, and concludes with short summaries of Despatch Procedure, Melting Cost, the Estimate Sheet, and how the latter may be used as a cost sheet so that results may be compared with estimates.

The recommendations are published in one booklet, supplemented by a second booklet containing the standard forms, with specimen entries as they are referred to in the text.

P. C. P. F.

### SCIENCE FOR THE YOUNG

**"The New Materials."** *By Gerald Leach. Published by Phoenix House Ltd., 38 William IV Street, Charing Cross, London. Pp.* 71. *Price* 9*s.* 6*d.*

AIMED at the young and those unschooled in the technological achievements of modern science, this book is a further publication in the Phoenix "Progress of Science" series. The author, a science graduate and journalist, introduces his subject with a survey of the effects of the new materials on everyday life, taking as examples airliners, satellites, rockets, atomic power stations, and electronic equipment of various kinds.

In Chapter II the new metals are discussed, and the weight, strength, and temperature-resistant properties demanded by many applications are considered, the alloying of metals to develop new properties is described, and a simplification of alloy structure is attempted. The author goes on to discuss briefly titanium, chromium, nickel, and the Nimonic alloys, as well as zirconium, beryllium, molybdenum, niobium, uranium, thorium, and tantalum.

Mere listing of the subjects touched on, as in the preceding paragraph, can convey no idea of the style of the book,

which is aimed at stimulating and holding the attention of the young reader from 12 years upwards. It does this successfully, and at least one schoolboy known to this reviewer was stimulated to ask further questions as each chapter was read. The diagrams are clear, and manage to convey simply ideas that are difficult to describe.

The linking of atoms into molecules and the "giant chains" are dealt with in Chapter III, and thus plastics are introduced. In Chapter IV, the uses of plastics are dealt with, and in Chapter V the author discusses materials of the future, and the changes that may result from developments that are now only in their infancy. The final chapter touches on careers with new materials, and it may well be that some of the young readers of this book may thus have their attention drawn for the first time to careers in science.

# Electricity Board Scrap Metal Disposals

An inquiry which has taken some two months has now resulted in a report to the Minister of Power. The inquiry was instituted as a result of allegations made by Mr. G. R. Strauss, M.P., in a letter to the Paymaster General stating that the methods adopted by the London Electricity Board for its disposal of scrap cable was unsatisfactory, and that the Board was responsible for loss of substantial sums of public money and other serious deficiencies in administration.

The inquiry was placed in the hands of Mr. Henry Benson, a chartered accountant, and his report has now been published by H.M. Stationery Office. The Minister of Power ordered the inquiry to take place in July last.

In his report, Mr. Benson summarizes his nine findings under three main headings under which allegations were made. These headings are as follows:—*Section I*—That the method adopted by the L.E.B. for disposing of scrap cable was unsatisfactory, and an alternative method should be adopted; *Section II*—that, as a result of its method of disposal of scrap cable, the L.E.B. was responsible for loss of public money and other serious deficiencies in administration; and *Section III*—that there were suspicions in the scrap metal trade that the adherence by the L.E.B. to its method of disposing of scrap cable indicated that a person or persons on the Board had an ulterior or improper motive for doing so.

## Findings

As regards the first section, the findings are:—

(1) In 1954 the Board was justified in adopting the method of disposing of cable by annual contracts and adhering to it thereafter. Subject to a reservation made in his next finding, there was no justification for requiring the Board to adopt an alternative method in the future.

(2) The Board should, from time to time in future, make an independent check of its contract prices by collecting scrap cable in lots of convenient size in at least one district. The lots should be sold by tender after inspection by the merchants or, alternatively, tenders should be invited from cable manufacturers and the scrap metal trade on the basis of a clearing and stripping charge. The net realizations should be compared with the sums realized under the Board's present method after taking into account any additional expense which a change would involve.

As regards Section II, the finding is:—

(3) That the allegations of loss of substantial sums of public money and other serious deficiencies in administration—claimed to be a result of the method of disposal—are not justified.

As regards Section III, the findings are as follows:—

(4) In 1952 a member of the Board's purchasing staff under the purchasing officer purchased a car for his private use from a company of scrap metal merchants which was regularly submitting tenders to the Board. This transaction should not have taken place.

(5) The foregoing transaction could not have had any influence or bearing upon the Board's decision to adopt the present tendering procedure in 1954 or to adhere to that system thereafter.

(6) With the exception referred to in finding No. 4, the suspicions of the scrap metal trade as regards the integrity of the Board's staff are unsupported by fact or evidence.

(7) Although the receipt of gifts at Christmas time by the Board's purchasing staff is known to and approved by the chairman and deputy chairman of the L.E.B., the Board should reconsider the matter with a view to bringing the practice to an end.

(8) There is no substance in any of the three specific complaints, details of which were furnished to me, that the Board conducts its business unfairly.

(9) The system laid down by the Board for controlling scrap cable from the time it arises until it is delivered to the merchant is sound."

## Scope of Inquiry

During the course of his inquiry, Mr. Benson discussed these matters with Mr. Strauss, with the Board chairman and deputy chairman and officials, met scrap merchants, and ascertained the methods of disposal of scrap cable adopted by the Ministry of Supply, Post Office, London Transport, and six other Electricity Boards.

He gives the total tonnages of scrap cable arising in the L.E.B. area and gross sale proceeds for the past four years. The cable in question was unarmoured and armoured underground cable thrown up by modernization and standardization work, and varied widely in copper and lead content, as before nationalization 40 electricity undertakings served the area and each laid down the cable it thought appropriate.

Some of the undertakings which the L.E.B. succeeded had sold lots by tender after prior inspection by merchants, while others had sold scrap cable back to manufacturers. By a new method which was adopted in 1954, the Board invited merchants each February to tender for scrap material which would become available from time to time in the ensuing year. Merchants were invited to view specimen samples.

Conditions of tender provided for price adjustments to be made during the year according to current market prices of copper and lead. Among the Board's reasons for the present procedure were that the quantity was larger than in other Boards, it was all underground cable, and London had a special problem of finding storage. The short time between receipt at and clearance from depots was economical.

## Attitude of Trade

Some but not all scrap merchants complained about the system. The trade said most large merchants refused to tender because they did not know what they were buying and would not enter into a gamble. They claimed they should inspect the material before tendering.

Mr. Benson goes on to say he does not think justified a complaint that the system gave an advantage to a few merchants whose past experience gave them knowledge of the type of cable thrown up in various districts.

Of Mr. Strauss's charge that the present system must lose the Board tens of thousands of pounds a year, Mr. Benson says that in such a highly competitive trade it appeared more probable that, as a result of tenders which could be submitted by any member of the trade, the prices obtained were satisfactory.

The Board, exercising a normal commercial judgment, was justified in adopting and adhering to the present method. In his opinion it was obvious that the allegations of loss of substantial sums and deficiencies in administration could not in any way be substantiated.

The whole report covers three dozen pages, and following the summary of allegations and findings there are four appendices. The first gives the correspondence which is referred to in the earlier part of the report; the second presents a summarized chart of the organization of the London Electricity Board to the extent that it affected this particular enquiry; the third appendix provides a schedule showing the number of tenders submitted for scrap cable from April, 1954, to August, 1958, in the seven districts of the Board; and the fourth appendix comprises a statement comparing the gross average price per ton realized for scrap cable by the Board and by six other electricity boards for each of the four years ended March 31, 1958.

In the course of the report, a number of figures are given relating to tonnages of cable for scrap and the gross proceeds of sales for several years. The practice of the L.E.B. in these matters are also dealt with, and methods adopted by other national undertakings are referred to.

# Industrial News *Home and Overseas*

**Aluminium Refrigerator Wagons**

What are believed to be the first refrigerator wagons of all-aluminium construction have recently been built for Canadian National Railways. The five prototypes are the outcome of maintenance and corrosion troubles experienced with conventional wagons and attributable to the brine solution used in the cooling systems.

These new wagons, designed by the C.N.R. in conjunction with the **Aluminum Company of Canada Ltd.,** and the builders, National Steel Car, embody certain special features that are creating wide interest in the North American industry. These include a composite riveted and welded aluminium underframe; an all-welded aluminium floor with a curved inside sill section to facilitate thorough cleaning; and aluminium brine tanks equipped with drain tubes leading to air-tight drain traps to feed overflow directly from the wagon. Two of the wagons are provided with an improved type of aluminium meat rack, while in all cases the design allows an increased thickness of insulation material to be used. Insulation is further improved by the reflectivity of the unpainted aluminium sheet roofs and walls.

With the exception of the bogies, charcoal heater, door and hatch hardware, and certain safety equipment, all parts of the wagons are of aluminium, which has resulted in each wagon being some 22·5 per cent lighter in weight than those previously operated by C.N.R. These five prototype units are being subjected to a programme of tests more extensive than any previously carried out in Northern America, and it is expected to eliminate the customary service testing requirements by the Canadian Railways of five to ten years on new equipment. A fatigue test will be undertaken and reproduced by Alcan's research affiliate, Aluminium Laboratories Limited, at Kingston, Ontario, and finally there will be a series of impact tests.

**A London Conversazione**

On Thursday, January 22 next year, the Corrosion Group of the **Society of Chemical Industry** will hold its conversazione at the Battersea College of Technology. As usual, exhibits illustrating corrosion work carried out in the laboratory or in service will be displayed, and the Group invites offers to provide exhibits from those interested.

On this occasion, apparatus and techniques are to be specially featured but it is understood that an exhibit illustrating recent or current corrosion work will be welcome. Full particulars relating to this event may be obtained from Dr. L. L. Shreir, The Battersea College of Technology, Battersea Park Road, London, S.W.11.

**Powder Metallurgy Symposium**

On Tuesday and Wednesday of next week (December 16 and 17), the Powder Metallurgy Joint Group of the Iron and Steel Institute and the Institute of Metals is holding a Symposium on the **Powder Metallurgy of Ceramic-Metal Materials** at Church House, Great Smith Street, Westminster, S.W.1. The meeting on Tuesday will consist of an introductory lecture at 6.30 p.m. by Dr. P. Murray of the A.E.R.E.

Starting at 9.30 a.m. on the next day, a series of invited Papers will be presented as follows:—"Fabrication and Properties of Chromium-Alumina and Molybdenum - Chromium - Alumina Cermets"; "The Fabrication and Properties of Uranium Oxide - Iron Cermets"; "Recent Developments in the Field of the Borides and Silicides of High-Melting-Point Transition Metals"; "Bonding in Carbides, Silicides and Borides"; "The Oxidation of Zirconium Carbide in High-Temperature Combustion Gases"; and "The High-Temperature Properties of Ceramics and Cermets."

**A Visit to Britain**

Members of the European Pressure Diecasting Committee paid a three-day visit to London recently, when they examined various technical and economic aspects of die-casting. Representatives attended from eight countries—Spain, Holland, Sweden, Denmark, Italy, Germany, France, and Switzerland.

Included in their itinerary was a visit to the die-casting shops of Sparklets Limited, at Tottenham, and during a tour of the factory they saw this company's zinc, aluminium, and soft alloy die-casting foundries.

During the visitors' stay in this country, arrangements were discussed for the next International Conference, and it is believed that this will probably be held in Stresa, Italy, in the May of 1960. The members were also guests of the Zinc Development Association, the Consolidated Zinc Corporation, and Fry's Diecastings Ltd. They also saw the new foundry of the Wolverhampton Die Casting Company Ltd.

**A London Meeting**

Another meeting in London on Tuesday next is that for the members of the **Association of Bronze and Brass Founders** in that area. This meeting will be held at the Clarendon Restaurant, Hammersmith, W.6, at 2.30 p.m., and will be preceded by a Christmas luncheon at 12.30 p.m.

**The V.E. Warrant**

In view of the interest shown by the industry in the V.E. Warrant since it was announced in September last, Mr. R. W. Holmes, chairman of the Holloware Division of the **Vitreous Enamel Development Council,** has recently made the following comment:—

"Many letters have been received from members of the public, and they have expressed a real liking for the colourfulness and hygiene of vitreous enamelware. Some of these letters, however, asked for more specific details of exactly how the warrant works. It occurred to me, therefore, that some of our friends in the trade might feel the same—as to how the warrant is to be applied. I would like to re-affirm that the V.E. Approved seal is applied to the vitreous enamels manufactured by members of the Holloware Division of the Vitreous Enamel Development Council. It guarantees replacement of an article within 12 months if the vitreous enamel fails in normal use because of material or manufacturing fault.

"There is a very important feature, however, on the operation of this warrant —it is a good faith warrant between the manufacturer and consumer. Damage occurring in transit or in handling after leaving the manufacturer is a matter which is not covered by the warrant, but which will continue to be settled between the wholesaler and/or the retailer and the manufacturer, as has always been the case. We find it encouraging to get these letters from the public as, apart from their general appreciation of the warrant, they also express great interest in the 'New Look' for vitreous enamel holloware we have announced."

**Trade with Rhodesia**

Following a review of the organization of the U.K. Trade Commission Offices in Southern Rhodesia, it has been decided to close the Bulawayo office as from the end of this present year. In future, this area will be covered by the U.K. Trade Commission Office in Salisbury.

**New London Premises**

As from December 22 next, **Martin, Black and Company (Wire Ropes) Ltd.,** and their associate company—The Speedwell Wire Company Ltd.—will occupy new London office and warehouse accommodation at 25 Curtain Road, E.C.2. The new two-storey building has been designed specifically as a combined wire rope warehouse and sales office.

**A New Association**

At a press reception held in London last week the formation of the **British Metal Sinterings Association** was announced. This association includes the following founder members: Bound Brook Bearings Ltd.; The Manganese Bronze and Brass Co. Ltd.; Metal and Plastic Components Ltd.; The Morgan Crucible Co. Ltd.; John Rigby and Sons Ltd.; Sintered Metal Components (Chard) Ltd.; and Sintered Products Ltd. The secretaries are Peat, Marwick, Mitchell and Co., Beaufort House, Newhall Street, Birmingham, 3.

The aim of the association is to place at the service of industry the combined experience of its members. Enquiries to the secretaries will be forwarded to all member firms with the object of ensuring that the firm with the most experience in a particular field shall have the opportunity of putting forward the best solution to a problem in that field. The sintering industry is one which is already firmly established in every major country of the world, and its products are already in use throughout a vast variety of different industries.

In an industry not content to rest on its laurels, continuing research enables the industry to produce engineering components of great complexity of shape, in a wide variety of materials, to very close dimensional tolerances. It is felt by members of the association that this method of production, by lowering the

cost of the finished component, is substantially assisting our national economy. A fully illustrated brochure detailing the use of metal sinterings in industry has been produced, and may be obtained by application to the association secretaries.

**Aluminium Bus Shelter**

Stated to be the first two-storey structure in this country to be built entirely on structural light alloy supporting columns is the new £54,000 omnibus shelter which was opened in Manchester recently. This new shelter is capable of accommodating 1,000 people queueing for 23 bus services, and is built on an island site. It is 577 ft. long and 28 ft. wide.

The shelter, which is continuous except for a transverse 36 ft. wide slipway at the west end, has a central aisle, 12 ft. wide, throughout its length, with double-queue spaces on either side marked by handrails of aluminium alloy tube having an outside diameter of 1¾ in. One of the striking features of the structure is the use of extruded Duralumin "H" supporting columns and the extensive use of other aluminium alloys for the window frames and guide rails.

The two-storey central block has a 21 ft. radius reinforced concrete shell barrel roof, 2½ in. thick, and a first floor of 4 in. thick, two-way reinforced concrete slabs cast *in situ*. The extruded Duralumin columns are 8 in. by 4 in., with 14 in. by 4 in. columns at each corner made up of extruded sections welded together. The wall thickness of the columns is 0·28 in. Throughout the remainder of the shelter, the 4 in. thick concrete slab roof is supported at intervals of approximately 9 ft. by extruded 4 in. square Duralumin columns interspersed with 6 in. by 4 in. double-hollow sections, one part of which is used as an integral rainwater downpipe.

All the structural light alloy sections and plates—to B.S. 1476 HE30 and B.S.1477 HP30 respectively—were extruded by **James Booth and Company Ltd.** and supplied to Saunders-Roe (Anglesey) Ltd., who undertook the welding of the base plates, column caps and bearing plates for the roof supports, and also the fabrication of the door pillars and frames, and the supporting columns.

The total amount of light alloy supplied by James Booth was more than 12 tons, comprising 2,838 ft. of 4 in. sq. section; 319 ft. of 8 in. by 4 in. section, and 896 ft. of the special 6 in. by 4 in. section incorporating the integral downpipe. Over 900 lb. of ⅜ in. thick light alloy plate, and 745 ft. of T section, 4 in. by 3 in. and 5/16 in. thick—for fabricating into brackets and cleats for use in conjunction with the roof supports—were also supplied.

The extruded aluminium window frames, supplied by **Allan M. Williams (Chester) Ltd.**, are fixed to the supporting columns by cadmium-plated screws and tension plates, with the ¼ in. plate-glass windows held in the frames by similar screws and putty. The aluminium hand rails were supplied by the **Northern Aluminium Company Ltd.**

**New Factory**

A new factory of 16,000 ft$^2$ is now being erected for **Rocol Ltd.**, Swillington, near Leeds, for the development and manufacture of specialized molybdenized and other lubricants for industry. The company has already 38 specialized lubricants in production, and these are used the world over.

*Mr. Kenneth Peacock handing the silver salver to Mr. E. C. B. Rowley, at the Birmingham luncheon party last week, on the occasion of Mr. Rowley's retirement from active business. The salver was inscribed as follows:—"To Ted, alias E. C. B. Rowley, as a token of the affection and high esteem we signatories have for you"*

**A Presentation**

An interesting event took place at the Queen's Hotel, Birmingham, last week, when many personalities and leaders of the hardware industry met at a luncheon to honour **Mr. E. C. B. Rowley** on his retirement from **Harrison (Birmingham) Ltd.** after an association with the company of nearly thirty years. Following an excellent luncheon, a silver salver and a cheque were presented to Mr. Rowley by **Mr. Kenneth S. Peacock** (chairman of Guest, Keen and Nettlefolds (Midlands) Ltd. The salver was engraved with the names of many of Mr. Rowley's business associates and friends.

The cheque handed to Mr. Rowley was for £164 2s. 6d., this being the amount left over from donations of friends and trade associations. Mr. Rowley has since made this up to a round 200 guineas and presented this sum to the Royal Metal Trades Pension and Benevolent Society.

After some years in the teaching profession, Mr. Rowley joined the West Bromwich firm of Manifoldia Ltd. In 1919 he joined the staff of Guest, Keen and Nettlefolds Ltd., and later became chief sales organizer of that company, a position he held until 1929, when he resigned to become general manager of Harrison (Birmingham) Ltd. Many of Mr. Rowley's activities are referred to on another page in this journal (p. 496).

At the luncheon, **Mr. J. MacNish** (chairman of Harrison's) proposed a toast to Mr. Rowley, and this was seconded by **Sir Ernest Canning** (W. Canning and Company Ltd.). In reply, Mr. Rowley said that he had had a tremendous lot of fun out of his career, and a wonderful innings. In the ups and downs of his business life there had always been behind him a solid rock of good fellowship, and he was very thankful for this friendship and goodwill. He said that his four main aims in a successful business life had been good relations with customers, with suppliers, with competitors, and with the workpeople.

**Corrosion Group**

A meeting will be held in two sessions, at 2.30 p.m. and 5.30 p.m., on Friday next, December 19, at 14 Belgrave Square, London, S.W.1, under the auspices of the Corrosion Group of the **Society of Chemical Industry** for the discussion of modern views of fundamental electrochemical processes.

At 2.30 p.m., Dr. T. P. Hoar will speak on "Anodic Processes," and at 5.30 p.m. Dr. E. C. Potter will speak on "Cathodic Processes." This meeting is intended to enable corrosion workers to refresh their knowledge of electrochemistry and to learn something of the up-to-date views of the mechanism of electrode processes developed by electro-chemists working outside as well as inside the corrosion field.

**New Metal Association**

News from Toronto is to the effect that the Canadian Copper and Brass Development Association has been formed as a non-trading organization, supported by copper producers and manufacturers, to promote and develop the use of copper and its alloys and compounds, according to the Dow Jones Agency. Representing the copper industry in Canada, the Association is designed to provide assistance to all concerned with copper and its affiliations from producer to consumer. The Association will work in close co-operation with other similar organizations throughout the world and is a member of the Copper Development Directors' Committee, an international group with a free interchange of technical and promotional data.

**Nuclear Science Contracts**

Contracts have been placed by the National Institute for Research in Nuclear Science for electrical equipment to supply power to the magnet of the 7,000 million electron volt proton synchrotron which is being built for them by the United Kingdom Atomic Energy Authority at the Rutherford High Energy Laboratory at Harwell.

The **British Brown-Boveri Company Ltd.** has been awarded the contract for the convertor plant at a cost of over £500,000, and **The English Electric Company Ltd.** have received the contract for the rotating machinery at a cost of some £470,000.

**Data Processing**

A new quarterly journal with the above title is being published by Iliffe and Sons Limited next month (January). The contents of this new publication will cover the whole range of automatic aids to good management and administration, both commercial and industrial. Computers, punched card machinery and peripheral equipment will be critically examined by experts, and their use and newest applications described.

The best of current operational practices will be analysed and presented in

"Data Processing" in a form which enables top management and technical executives alike to apply them to their own particular problems. The annual subscription rate for this journal is £4.

### U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange warehouses at the end of the week to December 6 fell 283 tons to 17,073 tons, comprising London 6,000, Liverpool 9,553, and Hull 1,520 tons. A week earlier, the figure was 17,356 tons, of which 6,019 were in London, 9,817 in Liverpool, and 1,520 tons in Hull.

Copper stocks fell 475 tons to 5,996 tons, and comprised London 4,175, Liverpool 1,546, Birmingham 25, Manchester 250 tons, and Swansea nil. A week before, copper stocks totalled 6,471 tons, and comprised London 4,525, Liverpool 1,671, Birmingham 25, Manchester 250 tons, and Swansea nil.

### Brazilian Aluminium Plans

It has been reported from Rio de Janeiro that Brazilian aluminium output is to be raised to 42,500 metric tons by 1962 (35,000 in 1961 and 25,000 in 1960) on the basis of plans worked out by the Kaiser and Aluminio do Brasil companies. It is estimated that current output is about 8,000 metric tons annually, of which 6,000 are from Brasileira de Aluminio and 2,000 from Eletro-Quimaca Brasileira. This output, however, covers only one-third of the country's requirements.

Rich bauxite deposits have been found in the areas of Pocos de Caldas, Ouro Preto and Serra da Mutuca, all in Minas Gerais State.

### Wire Drawing Machinery

It has been reported to the Board of Trade by the British Embassy at Rome that Successori di Giovanni Rolla, Via Casilina 71, Rome, are planning to extend their activities and to set up a factory for the drawing of copper wire. They would, therefore, like to receive offers as soon as possible from United Kingdom manufacturers of machinery for the drawing of copper wire.

Successori di Giovanni Rolla trade in the import and export of metals. They are considered to be a suitable connection for United Kingdom firms. Manufacturers interested in this enquiry should write direct to the Italian concern. It would be appreciated if, at the same time, they would notify the Commercial Department, British Embassy, Villa Wolkonsky, Via Conte Rosso, 25, Rome, that they have done so.

## Scrap Metal Merchants

On Wednesday of last week, at the Midland Hotel, Birmingham, the half-yearly meeting of the **National Association of Non-Ferrous Scrap Metal Merchants** was held, under the chairmanship of **Mr. R. O. Barnett,** President of the Association.

After presenting his report (published in METAL INDUSTRY last week, 5/12/58) for the half-year, the President announced that in connection with the report made by Mr. Henry Benson on the methods adopted by the London Electricity Board for the disposal of scrap cable, etc., it was now understood that the Minister of Power was proposing to issue this report as a Parliamentary Paper. The President's report was adopted unanimously.

A short discussion then took place on the subject of the Clean Air Act, and several members gave their impressions of methods adopted to comply with that Act.

A suggestion was made by **Mr. R. W. Coley** that, in connection with the recurring thefts of metal reported by the police, early notice should be given to metal merchants by the police themselves. The present situation was that the secretary of the association was approached by the police authorities and he (the secretary) then had to send out notifications to members of these thefts. This meant that merchants did not have this information until up to 48 hours had elapsed, sometimes longer. Mr. Coley felt that the information should be supplied direct to merchants as soon as possible.

The President said that he felt the police had a fairly rapid system for circulating information about stolen jewellery, and he saw no reason why such system should not be adopted for the early notification of thefts of metal.

Some Birmingham members said that the system operated by the police in that district ensured that merchants were immediately told of such thefts, and particulars given of the stolen goods.

The meeting agreed that an attempt should be made to standardize an improved system of circulating such information throughout the country.

After a vote of thanks had been proposed to the chairman, the meeting closed.

## Parliamentary News

**By Our Lobby Correspondent**

The Prime Minister was again questioned in the Commons about supplies of beryllium. He said that the Atomic Energy Authority informed him that it was importing the mineral beryl and having it processed in this country. The Authority was also buying metal flake from France and had a contract with Imperial Chemical Industries for the conversion of the flake into metal in the shapes required.

Mr. Roy Mason (Lab., Barnsley) then asked whether it was not the case that the metal would be valuable not only to the Atomic Energy Authority but to the aircraft industry as a whole. Could the Prime Minister say to what extent I.C.I., which had a monopoly in its production, had been assisted by research conducted and financed by the State authority?

The Prime Minister replied that those were matters of the general administration of the Authority and its day-to-day duties. He did not wish to go into great detail about them, for they were not matters which he, as the Minister in charge, should try too meticulously to control.

**British Aluminium Company.** — At Question Time in the Commons, Mr. H. Wilson (Lab., Huyton) asked the Chancellor of the Exchequer what applications he had received in relation to the future capitalization and/or ownership of the British Aluminium Company, and whether he would make a statement.

The Chancellor of the Exchequer, Mr. Heathcoat Amory, replied that he had received applications requiring Exchange Control approval and Capital Issues consent in respect of two sets of proposals affecting the future capitalization and ownership of the British Aluminium Company, and they were under consideration.

Mr. Wilson said that neither proposal could go forward without the Chancellor's permission, and he asked whether he was aware that the facts were very much in dispute. In view of the important issues involved, affecting both the question of foreign participation in control and also the rights of shareholders, would the Chancellor consider asking an independent lawyer or accountant to prepare for him a report on all the facts of the case and the issues at stake before he came to a decision?

Mr. Amory said that he agreed that both these applications raised important and difficult issues. The Government would give very careful and full consideration to them before announcing a decision.

## Forthcoming Meetings

**December 15—Institute of Metal Finishing.** London Branch. Northampton Polytechnic, St. John Street, London, E.C.1. "Trends in Polishing." J. P. Dewar. 6.15 p.m.

**December 16—Institute of Metal Finishing.** South West Branch. Grand Hotel, Bristol. "Metal Cleaning." J. E. Enthwhistle. 6.30 p.m.

**December 16 — Institute of British Foundrymen.** East Anglian Section. Lecture Hall, Public Library, Ipswich. Three talks on Sand Casting, Die-Casting, and Metallurgy of Aluminium Alloys, illustrated with film. 7.30 p.m.

**December 16—Institute of Metals.** South Wales Local Section. Department of Metallurgy, University College, Singleton Park, Swansea. "Properties of Metals at Very Low Temperatures." J. E. Aubrey. 6.30 p.m.

**December 16 and 17—Institute of Metals and Iron and Steel Institute.** Powder Metallurgy Joint Group. Church House, Great Smith Street, London, S.W.1. Symposium on "The Powder Metallurgy of Ceramic - Metal Materials."

**December 17 — Incorporated Plant Engineers.** Kent Branch. The King's Head Hotel, High Street, Rochester. "Treatment of Trade Effluents and Methods of Purification." T. Waldmeyer. 7 p.m.

**December 17—Institute of Metal Finishing.** Organic Finishing Group. Exchange and Engineering Centre, Stephenson Place, Birmingham, 2. "Polyester Finishes: Have They a Future?" B. M. Letsky. 6.30 p.m.

**December 19—Institute of Metal Finishing.** Sheffield and North-East Branch. Grand Hotel, Cavendish Room, Sheffield. "Automation in Electro-Plating Industry"—Film by Silvercrown Limited. 7 p.m.

**December 19 — Society of Chemical Industry.** Corrosion Group. Society of Chemical Industry, 14 Belgrave Square, London, S.W.1. "Modern Views of Electrochemical Processes." "Cathodic Processes," E. C. Potter; "Anodic Processes," T. P. Hoar. 2.30 p.m. and 5.30 p.m.

# Metal Market News

LAST week saw a somewhat unsettled background to the non-ferrous metal markets, for Wall Street staged one or two reactionary sessions, and on the London Stock Exchange prices were not very steady. However, trading on Friday finished on a fairly cheerful note, and although nobody looks for anything much in the way of business revival this year, there is no disposition to sell metals short. For a great many firms, stocktaking and end-of-year considerations are now becoming something of a preoccupation, and buying is restricted accordingly. However, there is a feeling that prices will remain reasonably steady over the turn of the year, for the situation gives no grounds for pessimism, and in the States the outlook appears to be reasonably good. Business is reported as being very quiet, and neither in this country nor on the Continent has there been any worthwhile volume of buying. It now seems pretty certain that users of copper, in this country at any rate, bought more than they actually required when the Rhodesian strike was on and in consequence they are now inclined to keep off the market and let their position run down. Current comment is that the arrival date of Rhodesian supplies is uncertain and, therefore, a possibility exists of a shortage re-occurring. Without confirmation, there have been reports of re-sales of copper by users in this country. Scrap appears to be plentiful but dealers say that it is not easy to find buyers, except for rather limited quantities. There is a fairly good demand for high-grade bright H.C. copper wire.

The most interesting development in copper last week was the reduction by two important custom smelters to 28½ cents, but it was understood that the American Smelting and Refining Co. maintained its price at 29 cents. Business was reported to be fairly brisk at 28½ cents, and some buying was done at 29 cents for January delivery. On Comex the price movements were erratic, following London, and it was fairly evident that the sterling quotation was influencing New York. The producers held their price at 29 cents. On Wednesday, when news of the cut to 28½ cents came through, the midday quotation in Whittington Avenue fell to £217 5s. 0d. cash and £217 10s. 0d. three months. This proved to be the low point for the week, for a modest recovery set in, but the market closed below the best at £220 10s. 0d. cash and £221 three months on a turnover of 9,100 tons. This registered a loss of £7 15s. 0d. for cash and of £7 5s. 0d. in three months, a contango of 10s. being established. A moderate business was done on the Kerb. At the beginning of the week, stocks in L.M.E. warehouses were reported 250 tons up at 6,471 tons, and it really looks as though the tide has turned and is now setting towards an improved stock position. So far the build-up has been rather slow, but things may well get better. In midweek, in sympathy with London, the Belgian price fell to 31·50 francs per kilo.

All the other metals followed the lead given by copper, and lost ground, tin finally closing 30s. down for cash and £2 lower for three months. Stocks in Metal Exchange warehouses dropped by 37 tons to 17,356 tons, but there is no difficulty in maintaining a useful contango on the market. Business with consumers is reported to be only moderate, but the price structure now seems sound enough, and little change is expected during the coming weeks. Zinc and lead closed above the lowest, but price movements were rather erratic and relatively wide changes occurred from day to day. In zinc, there was a turnover of 8,325 tons, December closing at £74 10s. 0d. and March at £71 10s. 0d., these prices being £1 15s. 0d. down on balance. The backwardation of £3 was maintained. For lead, the quotation for the current month dropped by £1 15s. 0d. to £73 5s. 0d., while March was £1 7s. 6d. down at £73 10s. 0d. Opinion about these two metals is mixed, but on the whole the future is regarded with a fair amount of optimism.

### Birmingham

The continued quietness of demand from consumers seems likely to continue now until at least the turn of the year. In some parts of the Midland metal-consuming area, the lack of new business is causing much unemployment, and some men who have been steadily employed for many years now find themselves out of a job, with the prospect of getting in again distinctly unfavourable. The slowing down in the building trade has reduced the demand for brass and copper castings and pressings, but against this the suppliers of metal fittings for the motor car manufacturers are well situated for orders. Once again labour disputes have been holding up production in the car factories. Due to falling off in industrial activity generally, there is less work among the builders of commercial vehicles.

Midland output of iron castings is not as high as it was a year ago, but is expected to show a better return at the end of this quarter, due to the lifting of monetary restrictions. There is an abundance of pig iron to meet all requirements of the foundries. Similarly, the stocks of semi-finished steel are more than ample to take care of the output of re-rolled steel at the Black Country mills, most of which are now only working short time. Although a substantial tonnage of heavy structural steel is being used locally on rebuilding schemes in town centres, the outlook for next year is not favourable, judging by the scarcity of new business coming forward each week. Sheet mills continued well employed.

### New York

Copper was steady over the week-end, but quiet. Futures copper, after early unsteadiness, recovered on trade buying. Custom smelters reported quiet conditions in copper, but noted a steady undertone to the market. Producers indicated quiet business. One leading producer source said a pre-holiday atmosphere was beginning to prevail in copper, with tax inventory buying by consumers generally completed. With an adequate supply of copper available for January, the disposition on the part of consumers is to "wait and see." Tin was quiet and very steady. Lead and zinc were patchy, with Prime Western zinc relatively more active than lead.

An order worth more than 3,000,000 dollars has been received by Westinghouse Electric Corporation for motor and control equipment to drive a new aluminium strip mill being built by Reynolds Metals Company at Listerhill, Alabama. The new mill is part of an expansion programme that will make the Listerhill plant one of the world's major aluminium rolling mills.

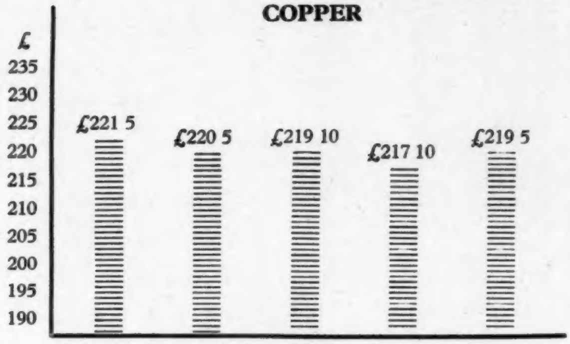
Dr. Hugh Odishaw, a leading American scientist, has predicted that the oceans will yield immense quantities of material resources within a century or so. Dr. Odishaw is executive director of the U.S. National Committee for the International Geophysical Year (I.G.Y.).

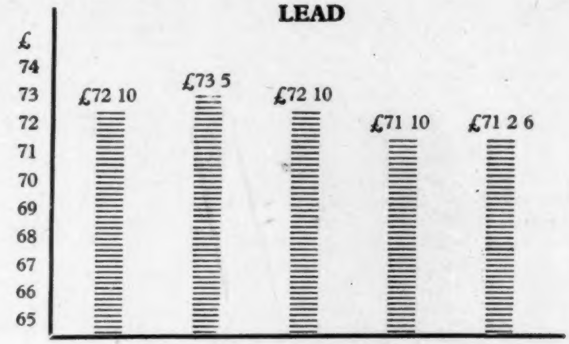
Discussing the progress of international scientific co-operation in the I.G.Y., ending this month, he said: "I have not the slightest doubt, quite aside from space science, that we are on the verge of many new and radical developments. . . . Within a century or so the oceans can become serious competitors of the Continents in terms of material resources. Within the same period, it is likely that the energy and material resources of the deeps of the earth will initially be tapped."

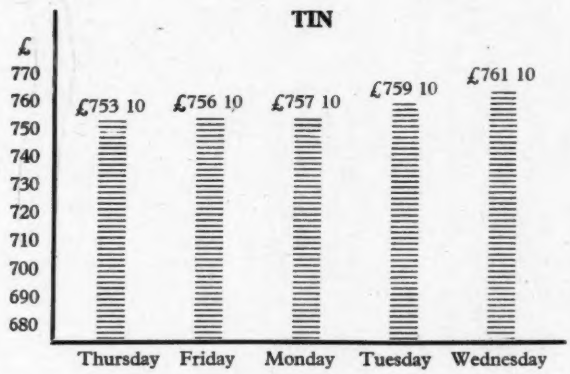
Dr. Odishaw reported that a vast mineral-rich region in the Pacific had been discovered during an I.G.Y. study of ocean floors. "Millions of square miles of the bed of the south-east Pacific bear a sludge laden with nodules of manganese and iron, with up to one per cent of cobalt mixed with copper," he declared. "The value of these minerals is estimated at about 500,000 dollars per sq. mile, and the economies of dredging up the sludge appear promising."

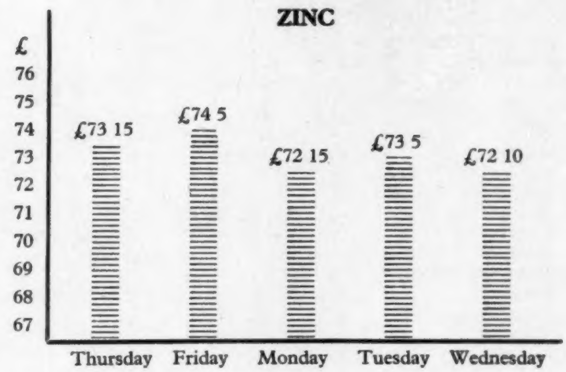
# METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 4 December 1958 to Wednesday 10 December 1958




# OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

| | Belgium fr/kg ≏ £/ton | | Canada c/lb ≏ £/ton | | France fr/kg ≏ £/ton | | Italy lire/kg ≏ £/ton | | Switzerland fr/kg ≏ £/ton | | United States c/lb ≏ £/ton | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Aluminium** | | | 22.50 | 185 17 6 | 210 | 182 15 | 375 | 217 10 | 2.50 | 209 0 | 26.80 | 214 10 |
| **Antimony** 99.0 | | | | | 195 | 169 12 6 | 445 | 256 2 6 | | | 29.00 | 232 0 |
| **Cadmium** | | | | | 1,500 | 1,305 0 | | | | | 145.00 | 1,160 0 |
| **Copper** | | | | | | | | | | | | |
| Crude | | | | | | | | | | | | |
| Wire bars 99.9 | | | | | | | 440 | 255 5 | | | | |
| Electrolytic | 31.50 | 230 5 | 28.50 | 235 10 | 278 | 241 17 6 | | | 3.15 | 263 10 0 | 29.00 | 232 0 |
| **Lead** | | | 11.75 | 97 0 | 115 | 100 0 | 177 | 102 12 6 | .95 | 79 10 0 | 13.00 | 104 0 |
| **Magnesium** | | | | | | | | | | | | |
| **Nickel** | | | 70.00 | 578 5 | 1,205 | 1,048 7 6 | 1,300 | 754 0 | 7.50 | 627 2 6 | 74.00 | 592 0 |
| **Tin** | 106.75 | 780 7 6 | | | 929 | 808 5 | 1,460 | 846 17 6 | 9.00 | 752 10 | 99.25 | 794 0 |
| **Zinc** | | | | | | | | | | | | |
| Prime western | | | 11.50 | 95 0 0 | | | | | | | 11.50 | 92 0 |
| Highgrade 99.95 | | | 12.10 | 100 0 0 | | | | | | | | |
| Highgrade 99.99 | | | 12.50 | 103 5 0 | | | | | | | | |
| Thermic | | | | | 107.12 | 93 2 6 | | | | | | |
| Electrolytic | | | | | 115.12 | 100 2 6 | 176 | 102 0 | .93 | 75 5 | 12.75 | 102 0 |

# NON-FERROUS METAL PRICES

(All prices quoted are those available at 2 p.m. 10/12/58)

## PRIMARY METALS

| | | £ | s. | d. |
|---|---|---|---|---|
| **Aluminium** Ingots | ton | 180 | 0 | 0 |
| **Antimony** 99·6% | „ | 197 | 0 | 0 |
| **Antimony** Metal 99% | „ | 190 | 0 | 0 |
| **Antimony** Oxide | „ | 180 | 0 | 0 |
| **Antimony Sulphide** Lump | „ | 190 | 0 | 0 |
| **Antimony Sulphide** Black Powder | „ | 205 | 0 | 0 |
| **Arsenic** | „ | 400 | 0 | 0 |
| **Bismuth** 99·95% | lb. | | 16 | 0 |
| **Cadmium** 99·9% | „ | | 9 | 6 |
| **Calcium** | „ | 2 | 0 | 0 |
| **Cerium** 99% | „ | 16 | 0 | 0 |
| **Chromium** | „ | | 6 | 11 |
| **Cobalt** | „ | | 16 | 0 |
| **Columbite** per unit | | | — | |
| **Copper** H.C. Electro | ton | 219 | 5 | 0 |
| Fire Refined 99·70% | „ | 218 | 0 | 0 |
| Fire Refined 99·50% | „ | 217 | 0 | 0 |
| **Copper Sulphate** | „ | 78 | 0 | 0 |
| **Germanium** | grm. | | — | |
| **Gold** | oz. | 12 | 10 | 5¾ |
| **Indium** | „ | | 10 | 0 |
| **Iridium** | „ | 20 | 0 | 0 |
| **Lanthanum** | grm. | | 15 | 0 |
| **Lead** English | ton | 71 | 2 | 6 |
| **Magnesium** Ingots | lb. | | 2 | 5½ |
| Notched Bar | „ | | 2 | 10½ |
| Powder Grade 4 | „ | | 6 | 3 |
| Alloy Ingot, A8 or AZ91 | „ | | 2 | 8 |
| **Manganese Metal** | ton | 290 | 0 | 0 |
| **Mercury** | flask | 74 | 0 | 0 |
| **Molybdenum** | lb. | 1 | 10 | 0 |
| **Nickel** | ton | 600 | 0 | 0 |
| F. Shot | lb. | | 5 | 5 |
| F. Ingot | „ | | 5 | 6 |
| **Osmium** | oz. | | nom. | |
| **Osmiridium** | „ | | nom. | |
| **Palladium** | „ | 5 | 15 | 0 |
| **Platinum** | „ | 19 | 10 | 0 |
| **Rhodium** | „ | 40 | 0 | 0 |
| **Ruthenium** | „ | 15 | 0 | 0 |
| **Selenium** | lb. | | nom. | |
| **Silicon** 98% | ton | | nom. | |
| **Silver** Spot Bars | oz. | | 6 | 4⅜ |
| **Tellurium** | lb. | | 15 | 0 |
| **Tin** | ton | 760 | 10 | 0 |
| ***Zinc** | | | | |
| Electrolytic | ton | | — | |
| Min 99·99% | „ | | — | |
| Virgin Min 98% | „ | 71 | 2 | 6 |
| Dust 95/97% | „ | 109 | 0 | 0 |
| Dust 98/99% | „ | 115 | 0 | 0 |
| Granulated 99+% | „ | 96 | 2 | 6 |
| Granulated 99·99+% | „ | 110 | 2 | 6 |

**Duty and Carriage to customers' works for buyers' account.*

## INGOT METALS

| Aluminium Alloy (Virgin) | | £ | s. | d. |
|---|---|---|---|---|
| B.S. 1490 L.M.5 | ton | 210 | 0 | 0 |
| B.S. 1490 L.M.6 | „ | 202 | 0 | 0 |
| B.S. 1490 L.M.7 | „ | 216 | 0 | 0 |
| B.S. 1490 L.M.8 | „ | 203 | 0 | 0 |
| B.S. 1490 L.M.9 | „ | 203 | 0 | 0 |
| B.S. 1490 L.M.10 | „ | 221 | 0 | 0 |
| B.S. 1490 L.M.11 | „ | 215 | 0 | 0 |
| B.S. 1490 L.M.12 | „ | 223 | 0 | 0 |
| B.S. 1490 L.M.13 | „ | 216 | 0 | 0 |
| B.S. 1490 L.M.14 | „ | 224 | 0 | 0 |
| B.S. 1490 L.M.15 | „ | 210 | 0 | 0 |
| B.S. 1490 L.M.16 | „ | 206 | 0 | 0 |
| B.S. 1490 L.M.18 | „ | 203 | 0 | 0 |
| B.S. 1490 L.M.22 | „ | 210 | 0 | 0 |

| | | £ | s. | d. |
|---|---|---|---|---|
| **†Aluminium Alloys (Secondary)** | | | | |
| B.S. 1490 L.M.1 | ton | 142 | 10 | 0 |
| B.S. 1490 L.M.2 | „ | 152 | 0 | 0 |
| B.S. 1490 L.M.4 | „ | 169 | 0 | 0 |
| B.S. 1490 L.M.6 | „ | 186 | 0 | 0 |

†Average selling prices for mid October

| | | £ | s. | d. |
|---|---|---|---|---|
| ***Aluminium Bronze** | | | | |
| BSS 1400 AB.1 | ton | 226 | 0 | 0 |
| BSS 1400 AB.2 | „ | 230 | 0 | 0 |
| ***Brass** | | | | |
| BSS 1400-B3 65/35 | „ | 144 | 0 | 0 |
| BSS 249 | „ | | — | |
| BSS 1400-B6 85/15 | „ | | — | |
| ***Gunmetal** | | | | |
| R.C.H. 3/4% ton | „ | | — | |
| (85/5/5/5) | „ | 178 | 0 | 0 |
| (86/7/5/2) | „ | 189 | 0 | 0 |
| (88/10/2/1) | „ | 237 | 0 | 0 |
| (88/10/2/½) | „ | 247 | 0 | 0 |
| **Manganese Bronze** | | | | |
| BSS 1400 HTB1 | „ | 178 | 0 | 0 |
| BSS 1400 HTB2 | „ | | — | |
| BSS 1400 HTB3 | „ | | — | |
| **Nickel Silver** | | | | |
| Casting Quality 12% | „ | | nom. | |
| „ „ 16% | „ | | nom. | |
| „ „ 18% | „ | | nom. | |
| ***Phosphor Bronze** | | | | |
| B.S. 1400 P.B.1 (A.I.D. released) | „ | 275 | 0 | 0 |
| B.S. 1400 L.P.B.1 | „ | 202 | 0 | 0 |
| **Phosphor Copper** | | | | |
| 10% | „ | 238 | 0 | 0 |
| 15% | „ | 241 | 0 | 0 |

**Average prices for the last week-end.*

| | | £ | s. | d. |
|---|---|---|---|---|
| **Phosphor Tin** | | | | |
| 5% | ton | | — | |
| **Silicon Bronze** | | | | |
| BSS 1400-SB1 | „ | | — | |
| **Solder,** soft, BSS 219 | | | | |
| Grade C Tinmans | „ | 355 | 3 | 0 |
| Grade D Plumbers | „ | 286 | 6 | 0 |
| Grade M | „ | 389 | 9 | 0 |
| **Solder,** Brazing, BSS 1845 | | | | |
| Type 8 (Granulated) | lb. | | — | |
| Type 9 | „ | | — | |
| **Zinc Alloys** | | | | |
| Mazak III | ton | 103 | 17 | 6 |
| Mazak V | „ | 107 | 17 | 6 |
| Kayem | „ | 113 | 17 | 6 |
| Kayem II | „ | 119 | 17 | 6 |
| Sodium-Zinc | lb. | | 2 | 6 |

## SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

| Aluminium | | £ | s. | d. |
|---|---|---|---|---|
| Sheet 10 S.W.G. | lb. | | 2 | 8⅛ |
| Sheet 18 S.W.G. | „ | | 2 | 10⅛ |
| Sheet 24 S.W.G. | „ | | 3 | 1½ |
| Strip 10 S.W.G. | „ | | 2 | 8⅛ |
| Strip 18 S.W.G. | „ | | 2 | 9⅛ |
| Strip 24 S.W.G. | „ | | 2 | 11 |
| Circles 22 S.W.G. | „ | | 3 | 2⅛ |
| Circles 18 S.W.G. | „ | | 3 | 1⅛ |
| Circles 12 S.W.G. | „ | | 3 | 0⅛ |
| Plate as rolled | „ | | 2 | 8 |
| Sections | „ | | 3 | 2 |
| Wire 10 S.W.G. | „ | | 2 | 11⅛ |
| Tubes 1 in. o.d. 16 S.W.G. | „ | | 4 | 1 |

| | | £ | s. | d. |
|---|---|---|---|---|
| **Aluminium Alloys** | | | | |
| BS1470. HS10W. | lb. | | | |
| Sheet 10 S.W.G. | „ | | 3 | 1 |
| Sheet 18 S.W.G. | „ | | 3 | 3½ |
| Sheet 24 S.W.G. | „ | | 3 | 11 |
| Strip 10 S.W.G. | „ | | 3 | 1 |
| Strip 18 S.W.G. | „ | | 3 | 2¼ |
| Strip 24 S.W.G. | „ | | 3 | 10⅛ |
| BS1477. HP30M. | | | | |
| Plate as rolled | „ | | 2 | 11 |
| BS1470. HC15WP. | | | | |
| Sheet 10 S.W.G. | „ | | 3 | 9⅛ |
| Sheet 18 S.W.G. | „ | | 4 | 2 |
| Sheet 24 S.W.G. | „ | | 5 | 0⅛ |
| Strip 10 S.W.G. | „ | | 3 | 10⅛ |
| Strip 18 S.W.G. | „ | | 4 | 2 |
| Strip 24 S.W.G. | „ | | 4 | 9⅛ |
| BS1477. HPC15WP. | | | | |
| Plate heat treated | „ | | 3 | 6⅛ |
| BS1475. HG10W. | | | | |
| Wire 10 S.W.G. | „ | | 3 | 10⅛ |
| BS1471. HT10WP. | | | | |
| Tubes 1 in. o.d. 16 S.W.G. | „ | | 5 | 0⅛ |
| BS1476. HE10WP. | | | | |
| Sections | „ | | 3 | 1⅛ |
| **Beryllium Copper** | | | | |
| Strip | „ | 1 | 4 | 11 |
| Rod | „ | 1 | 1 | 6 |
| Wire | „ | 1 | 4 | 9 |
| **Brass** Tubes | „ | | 1 | 8⅞ |
| Brazed Tubes | „ | | — | |
| Drawn Strip Sections | „ | | — | |
| Sheet | ton | | — | |
| Strip | „ | 241 | 10 | 0 |
| Extruded Bar | lb. | | 1 | 11 |
| Extruded Bar (Pure Metal Basis) | „ | | — | |
| Condenser Plate (Yellow Metal) | ton | 177 | 0 | 0 |
| Condenser Plate (Naval Brass) | „ | 189 | 0 | 0 |
| Wire | lb. | | 2 | 6⅜ |
| **Copper** Tubes | lb. | | 2 | 1⅛ |
| Sheet | ton | 244 | 15 | 0 |
| Strip | „ | 244 | 15 | 0 |
| Plain Plates | „ | | — | |
| Locomotive Rods | „ | | — | |
| H.C. Wire | „ | 270 | 15 | 0 |
| **Cupro Nickel** | | | | |
| Tubes 70/30 | lb. | | 3 | 5⅜ |
| **Lead** Pipes (London) | ton | 112 | 5 | 0 |
| Sheets (London) | „ | 110 | 0 | 0 |
| Tellurium Lead | „ | £6 extra | | |
| **Nickel Silver** | | | | |
| Sheet and Strip 7% | lb. | | 3 | 7¼ |
| Wire 10% | „ | | 4 | 2 |
| **Phosphor Bronze** | | | | |
| Wire | „ | | 3 | 11⅛ |

| **Titanium** (1,000 lb. lots) | | | |
|---|---|---|---|
| Billet over 4″ dia.-18″ dia. | lb. | 63/- | 64/- |
| Rod 4″ dia.-·250″ dia. | „ | 75/- | 112/- |
| Wire under ·250″ dia.-·036″ dia. | „ | 146/- | 222/- |
| Sheet 8′ × 2′ × ·250″-·010″ thick | „ | 88/- | 157/- |
| Strip ·048″-·003″ thick | „ | 100/- | 350/- |
| Tube (representative gauge) | „ | | 300/- |
| Extrusions | „ | | 120/- |

| | | £ | s. | d. |
|---|---|---|---|---|
| **Zinc** Sheets, English destinations | ton | 108 | 5 | 0 |
| Strip | „ | | nom. | |

# Financial News

## Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for Sept., 1958, have been issued by the Ministry of Supply as follow (in long tons):—

| | |
|---|---|
| **Virgin Aluminium** | |
| Production | 1,742 |
| Imports | 22,524 |
| Despatches to consumers | 27,964 |
| **Secondary Aluminium** | |
| Production | 9,026 |
| Virgin content of above | 675 |
| Despatches (including virgin content) | 9,258 |
| **Secondary in Consumption** (per cent) | |
| Wrought products | 6·5 |
| Cast products | 87·0 |
| Destructive uses (aluminium content irrecoverable) | 71·7 |
| Total consumption | 29·4 |
| **Scrap** | |
| Arisings | 11,811 |
| Estimated quantity of metal recoverable | 8,249 |
| Consumption by: | |
| (a) Secondary smelters | 11,111 |
| (b) Other users | 1,239 |
| **Despatches of wrought and cast products** | |
| Sheet, strip and circles | 11,270 |
| Extrusions (excluding forging bar, wire-drawing rod and tube shell): | |
| (a) Bars and sections | 2,797 |
| (b) Tubes (i) extruded | 158 |
| (ii) cold drawn | 570 |
| (c) (i) Wire | 2,268 |
| (ii) Hot rolled rod (not included in (c) (i)) | 66 |
| Forgings | 287 |
| Castings: (a) Sand | 1,624 |
| (b) Gravity die | 3,621 |
| (c) Pressure die | 1,528 |
| **Foil** | 2,034 |
| **Paste** | 290 |
| **Magnesium Fabrication** | |
| Sheet and strip | 8 |
| Extrusions | 80 |
| Castings | 137 |
| Forgings | 3 |

**LIGHT METALS STATISTICS IN JAPAN**
(August, 1958)

| Classification | Production | Shipment | Stock | Export |
|---|---|---|---|---|
| Alumina | 22,867 | 15,798 | 20,106 | 0 |
| **Aluminium** | | | | |
| Primary | 7,876 | 7,207 | 2,528 | 277 |
| Secondary | 1,877 | 1,959 | 300 | 0 |
| Rolled Products | 5,734 | 5,576 | 1,921 | 400 |
| Electric Wire | 776 | 711 | 852 | 63 |
| Sheet Products | 1,347 | 1,295 | 1,217 | 62 |
| Castings | 1,618 | — | — | — |
| Die-Castings | 888 | — | — | — |
| Forgings | 15 | — | — | — |
| Powder | — | — | — | — |
| Primary Aluminium (September) | 7,604 | 7,277 | 2,855 | 206 |
| Sponge Titanium | 132 | 130 | 783 | 123 |
| Magnesium | 95 | 101 | 4 | 0 |
| Secondary | 178 | 156 | 263 | 0 |

## New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

**Purdue Metals Limited** (613565), 29 Smart Street, Luton, Beds. Registered October 24, 1958. To carry on business of importers, exporters, merchants of and dealers in waste paper, cardboard, metals, etc. Nominal capital, £3,000 in £1 shares. Directors: Robert W. Purdue, Samuel E. Bickle, John R. Purdue, Paul E. Purdue and Alfred W. K. Coles.

**Hartshead Plating Co. Limited** (613666), 14 Thomas Street, Sheffield, 3. Registered October 27, 1958. To carry on business of cutlers, electro platers, etc. Nominal capital, £1,000 in £1 shares. Directors: Ronald Wood and Wilfred Wood.

**W. Friend Limited** (613708), 31 Dereham Road, Watton, Norfolk. Registered October 27, 1958. To carry on business of machinery and metal merchants, marine store dealers, etc. Nominal capital, £5,000 in £1 shares. Directors: Horace Friend and Mrs. Vera Friend.

**E.K. Engineering Limited** (613716), 54 Calthorpe Road, Edgbaston, Birmingham, 15. Registered October 27, 1958. To carry on business of agents for the importation, exportation and purchase and sale of sheet metal fabrications, etc. Nominal capital, £100 in £1 shares. Directors: Ronald Engering, Mrs. J. E. Engering and Elsie D. King.

**Brankus Trading Company Limited** (613759), 128-134 Baker Street, W.1. Registered October 28, 1958. To carry on business of merchants of metals, wood, paper, cardboard, rags, rubber, etc. Nominal capital, £100 in £1 shares. Director: Bernard M. Igra.

**Liver Plating Company Ltd.** (613781), 4A B2 Newstet Road, Kirby Trading Estate, Liverpool. Registered October 28, 1958. To carry on business of electro-deposition of all metals, etc. Nominal capital, £5,000 in £1 shares. Directors: Philip G. Fielding and Dorothy Fielding.

**Underbody Protective Coatings Limited** (613882), 58 Grove Street, Sheffield, 3. Registered October 29, 1958. To carry on business of protective platers, etc. Nominal capital, £500 in £1 shares. Directors: Norman E. Brown and Philip W. Kirk.

# Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 9/12/58.

| | £ |
|---|---|
| **Aluminium** | |
| New Cuttings | 142 |
| Old Rolled | 120 |
| Segregated Turnings | 90 |
| **Brass** | |
| Cuttings | 134 |
| Rod Ends | 128 |
| Heavy Yellow | 105 |
| Light | 100 |
| Rolled | 124 |
| Collected Scrap | 103 |
| Turnings | 122 |
| **Copper** | |
| Wire | 185 |
| Firebox, cut up | 178 |
| Heavy | 174 |
| Light | 169 |
| Cuttings | 185 |
| Turnings | 165 |
| Braziery | 141 |
| **Gunmetal** | |
| Gear Wheels | 170 |
| Admiralty | 170 |
| Commercial | 147 |
| Turnings | 142 |
| **Lead** | |
| Scrap | 61 |
| **Nickel** | |
| Cuttings | — |
| Anodes | 500 |
| **Phosphor Bronze** | |
| Scrap | 147 |
| Turnings | 142 |
| **Zinc** | |
| Remelted | 56 |
| Cuttings | 42 |
| Old Zinc | 31 |

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

**West Germany** (D-marks per 100 kilos):

| | | |
|---|---|---|
| Used copper wire | (£182.15.0) | 210 |
| Heavy copper | (£182.15.0) | 210 |
| Light copper | (£152.5.0) | 175 |
| Heavy brass | (£104.10.0) | 120 |
| Light brass | (£82.12.6) | 95 |
| Soft lead scrap | (£58.5.0) | 67 |
| Zinc scrap | (£38.5.0) | 44 |
| Used aluminium unsorted | (£87.0.0) | 100 |

**France** (francs per kilo):

| | | |
|---|---|---|
| Copper | (£204.10.0) | 235 |
| Heavy copper | (£204.10.0) | 235 |
| Light brass | (£134.17.6) | 155 |
| Zinc castings | (£61.0.0) | 70 |
| Lead | (£86.2.6) | 99 |
| Tin | | — |
| Aluminium | (£117.10.0) | 135 |

**Italy** (lire per kilo):

| | | |
|---|---|---|
| Aluminium soft sheet clippings (new) | (£194.7.6) | 335 |
| Aluminium copper alloy | (£124.15.0) | 215 |
| Lead, soft, first quality | (£83.10.0) | 144 |
| Lead, battery plates | (£47.10.0) | 82 |
| Copper, first grade | (£203.0.0) | 350 |
| Copper, second grade | (£191.10.0) | 330 |
| Bronze, first quality machinery | (£197.5.0) | 340 |
| Bronze, commercial gunmetal | (£168.5.0) | 290 |
| Brass, heavy | (£136.7.6) | 235 |
| Brass, light | (£124.15.0) | 215 |
| Brass, bar turnings | (£127.12.6) | 220 |
| New zinc sheet clippings | (£58.0.0) | 100 |
| Old zinc | (£43.10.0) | 75 |

# THE STOCK EXCHANGE

## *Although Markets Not So Active Prices Generally Well Maintained*

| ISSUED CAPITAL • | AMOUNT OF SHARE | NAME OF COMPANY | MIDDLE PRICE 9 DECEMBER | +RISE —FALL | DIV. FOR LAST FIN. YEAR | DIV. FOR PREV. YEAR | DIV. YIELD | 1958 HIGH | 1958 LOW | 1957 HIGH | 1957 LOW |
|---|---|---|---|---|---|---|---|---|---|---|---|
| £ | £ | | | | Per cent | Per cent | | | | | |
| 4,435,792 | 1 | Amalgamated Metal Corporation ... | 23/6 | —9d. | 9 | 10 | 7 13 3 | 24/9 | 17/6 | 28/3 | 18/– |
| 400,000 | 2/– | Anti-Attrition Metal ... ... ... | 1/7½ | | 4 | 8½ | 4 18 6 | 1/9 | 1/3 | 2/6 | 1/6 |
| 38,305,038 | Stk. (£1) | Associated Electrical Industries ... | 57/6 | —3d. | 15 | 15 | 5 4 3 | 58/6 | 46/6 | 72/3 | 47/9 |
| 1,590,000 | 1 | Birfield ... ... ... ... ... | 56/6 | —9d. | 15 | 15 | 5 6 3 | 62/4½ | 46/3 | 70/– | 48/9 |
| 3,196,667 | 1 | Birmid Industries ... ... ... | 65/– | +6d. | 17½ | 17½ | 5 7 9 | 77/6 | 55/3 | 80/6 | 55/9 |
| 5,630,344 | Stk. (£1) | Birmingham Small Arms ... ... | 35/3 | | 11 | 10 | 6 4 9 | 37/3 | 23/9 | 33/– | 21/9 |
| 203,150 | Stk. (£1) | Ditto Cum. A. Pref. 5% ... ... | 15/– | | 5 | 5 | 6 13 3 | 16/1½ | 14/7½ | 16/– | 15/– |
| 350,580 | Stk. (£1) | Ditto Cum. B. Pref. 6% ... ... | 17/1½ | | 6 | 6 | 7 0 3 | 17/4½ | 16/6 | 19/– | 16/6 |
| 500,000 | 1 | Bolton (Thos.) & Sons ... ... | 26/9 | | 10 | 12½ | 7 9 6 | 28/9 | 24/– | 30/3 | 28/9 |
| 300,000 | 1 | Ditto Pref. 5% ... ... ... | 15/– | | 5 | 5 | 6 13 3 | 16/– | 15/– | 16/9 | 14/3 |
| 160,000 | 1 | Booth (James) & Co. Cum. Pref. 7% | 20/– | | 7 | 7 | 7 0 0 | 20/4½ | 19/– | 22/3 | 18/9 |
| 9,000,000 | Stk. (£1) | British Aluminium Co. ... ... | 70/3 | +4/– | 12 | 12 | 3 8 3 | 74/– | 36/6 | 72/– | 38/3 |
| 1,500,000 | Stk. (£1) | Ditto Pref. 6% ... ... ... | 19/6 | —3d. | 6 | 6 | 6 3 0 | 20/– | 18/4½ | 21/6 | 18/– |
| 15,000,000 | Stk. (£1) | British Insulated Callender's Cables | 49/6 | —1/– | 12½ | 12½ | 5 1 0 | 52/– | 38/9 | 55/– | 40/– |
| 17,047,166 | Stk. (£1) | British Oxygen Co. Ltd., Ord. ... | 44/6 | +9d. | 10 | 10 | 4 10 0 | 47/– | 28/3 | 39/– | 29/6 |
| 600,000 | Stk. (5/–) | Canning (W.) & Co. ... ... ... | 24/3 | | 25+ *2½C | 25 | 5 3 0 | 24/6 | 19/7½ | 24/6 | 19/3 |
| 60,484 | 1/– | Carr (Chas.) ... ... ... ... | 1/3 | | 25 | 25 | 20 0 0 | 2/3 | 1/4½ | 3/6 | 2/1½ |
| 150,000 | 2/– | Case (Alfred) & Co. Ltd. ... ... | 4/10½ | —1½d. | 25 | 25 | 10 5 3 | 5/3 | 4/– | 4/6 | 4/– |
| 555,000 | 1 | Clifford (Chas.) Ltd. ... ... ... | 21/6 | +6d. | 10 | 10 | 9 6 0 | 21/3 | 16/– | 20/6 | 15/9 |
| 45,000 | 1 | Ditto Cum. Pref. 6% ... ... | 15/6 | | 6 | 6 | 7 14 9 | 16/– | 15/– | 17/6 | 16/– |
| 250,000 | 2/– | Coley Metals ... ... ... ... | 3/– | —3d. | 20 | 25 | 13 6 9 | 4/6 | 2/6 | 5/7½ | 3/9 |
| 8,730,596 | 1 | Cons. Zinc Corp.† ... ... ... | 56/3 | —2/3 | 18¾ | 22½ | 6 13 3 | 58/9 | 41/– | 92/6 | 49/– |
| 1,136,233 | 1 | Davy & United ... ... ... | 81/9 | +3d. | 20 | 15 | 4 17 9 | 82/3 | 45/9 | 60/6 | 42/6 |
| 2,750.000 | 5/– | Delta Metal ... ... ... ... | 24/6 | | 30 | *17½ | 6 2 6 | 25/– | 17/7½ | 28/6 | 19/– |
| 4,160,000 | Stk. (£1) | Enfield Rolling Mills Ltd. ... ... | 34/6 | —3d. | 12½ | 15B | 7 5 0 | 38/– | 22/9 | 38/6 | 25/– |
| 750,000 | 1 | Evered & Co. ... ... ... ... | 28/– | | 15Z | 15 | 7 2 9 | 28/9 | 26/– | 52/9 | 42/– |
| 18,000,000 | Stk. (£1) | General Electric Co. ... ... ... | 37/6 | +1/6 | 10 | 12½ | 5 6 9 | 39/6 | 29/6 | 59/– | 38/– |
| 1,500,000 | Stk. (10/–) | General Refractories Ltd. ... ... | 36/3 | +6d. | 20 | 17½ | 5 10 3 | 39/3 | 27/3 | 37/– | 26/9 |
| 401,240 | 1 | Gibbons (Dudley) Ltd. ... ... | 67/– | —6d. | 15 | 15 | 4 9 6 | 67/6 | 61/– | 71/– | 53/– |
| 750,000 | 5/– | Glacier Metal Co. Ltd. ... ... | 7/3 | +3d. | 11¼ | 11¼ | 7 18 6 | 8/3 | 5/– | 8/1½ | 5/10½ |
| 1,750,000 | 5/– | Glynwed Tubes ... ... ... | 16/3 | —1½d. | 20 | 20 | 6 3 0 | 18/1½ | 12/10½ | 18/– | 12/6 |
| 5,421,049 | 10/– | Goodlass Wall & Lead Industries ... | 29/6 | +6d. | 13‖ | 18Z | 4 8 3 | 29/7½ | 17/3 | 37/3 | 28/9 |
| 342,195 | 1 | Greenwood & Batley ... ... | 57/6 | +2/6 | 20 | 17½ | 6 19 3 | 57/9 | 45/– | 50/– | 46/– |
| 396,000 | 5/– | Harrison (B'ham) Ord. ... ... | 15/6 | —3d. | *15 | *15 | 4 16 9 | 15/9 | 11/6 | 16/9 | 12/4½ |
| 150,000 | 1 | Ditto Cum. Pref. 7% ... ... | 19/9 | | 7 | 7 | 7 1 9 | 19/9 | 18/4½ | 22/3 | 18/7½ |
| 1,075,167 | 5/– | Heenan Group ... ... ... | 7/4½ | | 10 | 10‡ | 6 15 6 | 9/7 | 6/9 | 10/4½ | 6/9 |
| 236,953,260 | Stk. (£1) | Imperial Chemical Industries ... | 36/3 | +6d. | 12Z | 10 | 4 8 3 | 36/7½ | 27/7½ | 46/6 | 36/3 |
| 33,708,769 | Stk. (£1) | Ditto Cum. Pref. 5% ... ... | 17/– | | 5 | 5 | 5 17 9 | 17/1½ | 16/– | 18/6 | 15/6 |
| 14,584,025 | ** | International Nickel ... ... ... | 154½ | —½ | $2.60 | $3.75 | 2 19 6 | 169 | 132¾ | 222 | 130 |
| 430,000 | 5/– | Jenks (E. P.), Ltd. ... ... ... | 9/6 | +7½d. | 14 | 27½ϕ | 7 7 3 | 9/6 | 6/7½ | 18/10½ | 15/1½ |
| 300,000 | 1 | Johnson, Matthey & Co. Cum. Pref. 5% | 15/7½ | | 5 | 5 | 6 8 0 | 16/9 | 15/– | 17/– | 14/6 |
| 3,987,435 | 1 | Ditto Ord. ... ... ... ... | 45/3 | —3d. | 10 | 10 | 4 8 6 | 47/– | 36/6 | 58/9 | 40/– |
| 600,000 | 10/– | Keith, Blackman ... ... ... | 28/9 | | 17½ | 15 | 6 1 9 | 28/9 | 15/– | 21/9 | 15/– |
| 160,000 | 4/– | London Aluminium ... ... ... | 5/4½ | +3d. | 10 | 10 | 7 8 9 | 5/1½ | 3/– | 6/9 | 3/6 |
| 2,400,000 | 1 | London Elec. Wire & Smith's Ord. ... | 61/– | +6d. | 12½ | 12½ | 4 2 0 | 64/6 | 39/9 | 54/6 | 41/– |
| 400,000 | 1 | Ditto Pref. ... ... ... ... | 23/7½ | | 7½ | 7½ | 6 7 0 | 24/3 | 22/– | 25/3 | 21/9 |
| 765,012 | 1 | McKechnie Brothers Ord. ... ... | 45/– | | 15 | 15 | 6 13 3 | 45/– | 32/– | 48/9 | 37/6 |
| 1,530,024 | 1 | Ditto A Ord. ... ... ... | 45/– | +1/– | 15 | 15 | 6 13 3 | 45/– | 30/– | 47/6 | 36/– |
| 1,108,268 | 5/– | Manganese Bronze & Brass ... ... | 13/1½ | | 20 | 27½‡ | 7 12 6 | 14/1½ | 8/9 | 21/10½ | 7/6 |
| 50,628 | 6/– | Ditto (7½% N.C. Pref.) ... ... | 6/– | | 7½ | 7½ | 7 10 0 | 6/3 | 5/6 | 6/6 | 5/– |
| 13,098,855 | Stk. (£1) | Metal Box ... ... ... ... | 66/9 | +2/9 | 11 | 11 | 3 5 9 | 67/3 | 40/6 | 59/– | 40/3 |
| 415,760 | Stk. (2/–) | Metal Traders ... ... ... ... | 9/– | | 50 | 50 | 11 2 3 | 9/– | 6/3 | 8/– | 6/3 |
| 160,000 | 1 | Mint (The) Birmingham ... ... | 20/– | | 10 | 10 | 10 0 0 | 22/9 | 19/– | 25/– | 21/6 |
| 80,000 | 5 | Ditto Pref. 6% ... ... ... | 70/6 | | 6 | 6 | 8 10 3 | 83/6 | 70/6 | 90/6 | 83/6 |
| 3,705 670 | Stk. (£1) | Morgan Crucible A ... ... ... | 43/– | —3d. | 10 | 10 | 4 13 0 | 45/– | 34/– | 54/– | 35/– |
| 1,000,000 | Stk. (£1) | Ditto 5½% Cum. 1st Pref. ... | 17/6 | | 5½ | 5½ | 6 5 9 | 18/– | 17/– | 19/3 | 16/– |
| 2,200,000 | Stk (£1) | Murex ... ... ... ... ... | 52/6 | —1/4½ | 17½ | 20 | 6 10 3 | 58/9 | 47/9 | 79/9 | 57/– |
| 468,000 | 5/– | Ratcliffs (Great Bridge) ... ... | 10/6 | | 10 | 10 | 4 5 3 | 11/1½ | 6/10½ | 8/– | 6/10½ |
| 234,960 | 10/– | Sanderson Bros. & Newbould ... | 27/3 | | 20 | 27½D | 7 6 9 | 27/3 | 24/6 | 41/– | 24/9 |
| 1,365,000 | Stk. (5/–) | Serck ... ... ... ... ... | 18/– | | 15 | 17½ | 4 2 3 | 18/2½ | 11/– | 18/10½ | 11/6 |
| 6,698,586 | Stk. (£1) | Stone-Platt Industries ... ... | 43/– | —6d. | 15 | 12½ | 6 19 6 | 44/6 | 22/6 | 33/4½ | 22/7½ |
| 2,928,963 | Stk. (£1) | Ditto 5½% Cum. Pref. ... ... | 16/3 | | 5½ | 5½ | 6 15 6 | 16/3 | 12/7½ | 14/– | 12/9 |
| 14,494,862 | Stk. (£1) | Tube Investments Ord. ... ... | 78/– | +6d. | 17½ | 15 | 4 9 9 | 78/9 | 48/4½ | 70/9 | 50/6 |
| 41,000,000 | Stk. (£1) | Vickers ... ... ... ... | 34/3 | —6d. | 10 | 10 | 5 16 9 | 36/3 | 28/9 | 46/– | 29/– |
| 750,000 | Stk. (£1) | Ditto Pref. 5% ... ... ... | 15/6 | | 5 | 5 | 6 9 0 | 15/9 | 14/3 | 18/– | 14/– |
| 6,863,807 | Stk. (£1) | Ditto Pref. 5% tax free ... ... | 22/– | | *5 | *5 | 7 0 3A | 23/– | 21/3 | 24/9 | 20/7½ |
| 2,200,000 | 1 | Ward (Thos. W.), Ord. ... ... | 83/– | +9d. | 20 | 15 | 4 16 6 | 87/3 | 70/9 | 83/– | 64/– |
| 2,666,034 | Stk. (£1) | Westinghouse Brake ... ... ... | 42/– | —3d. | 10 | 18P | 4 15 3 | 43/6 | 32/6 | 85/– | 29/1½ |
| 225,000 | 2/– | Wolverhampton Die-Casting ... | 9/– | —9d. | 30 | 25 | 6 13 3 | 10/1½ | 7/– | 10/1½ | 7/– |
| 591,000 | 5/– | Wolverhampton Metal ... ... | 20/6 | —6d. | 27½ | 27½ | 6 14 3 | 22/9 | 14/9 | 22/3 | 14/9 |
| 78,465 | 2/6 | Wright, Bindley & Gell ... ... | 4/9 | +3d. | 20 | 17½E | 10 10 6 | 4/10½ | 2/9 | 3/9 | 2/7½ |
| 124,140 | 1 | Ditto Cum. Pref. 6% ... ... | 13/– | | 6 | 6 | 9 4 6 | 13/– | 11/3 | 12/6 | 11/3 |
| 150,000 | 1/– | Zinc Alloy Rust Proof ... ... | 2/9 | | 27 | 40D | 9 16 3 | 3/1½ | 2/7½ | 5/– | 2/9 |

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% Capitalized issue. • The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/- per share for £3 stock held. D and 50% capitalized issue Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ϕ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits.